The OIL AND GAS JOURNAL

PUBLISHED WEEKLY MAY 22, 1961

Aromatics outlook:

Surplus, but not a glut

p. 39

How Jersey uses higher math in solving operating problems

p. 42

P.D. meters end discrepancies and gaging at pipeline terminal

p. 70

New ton-mile tables help you get more life from wire line

p. 74

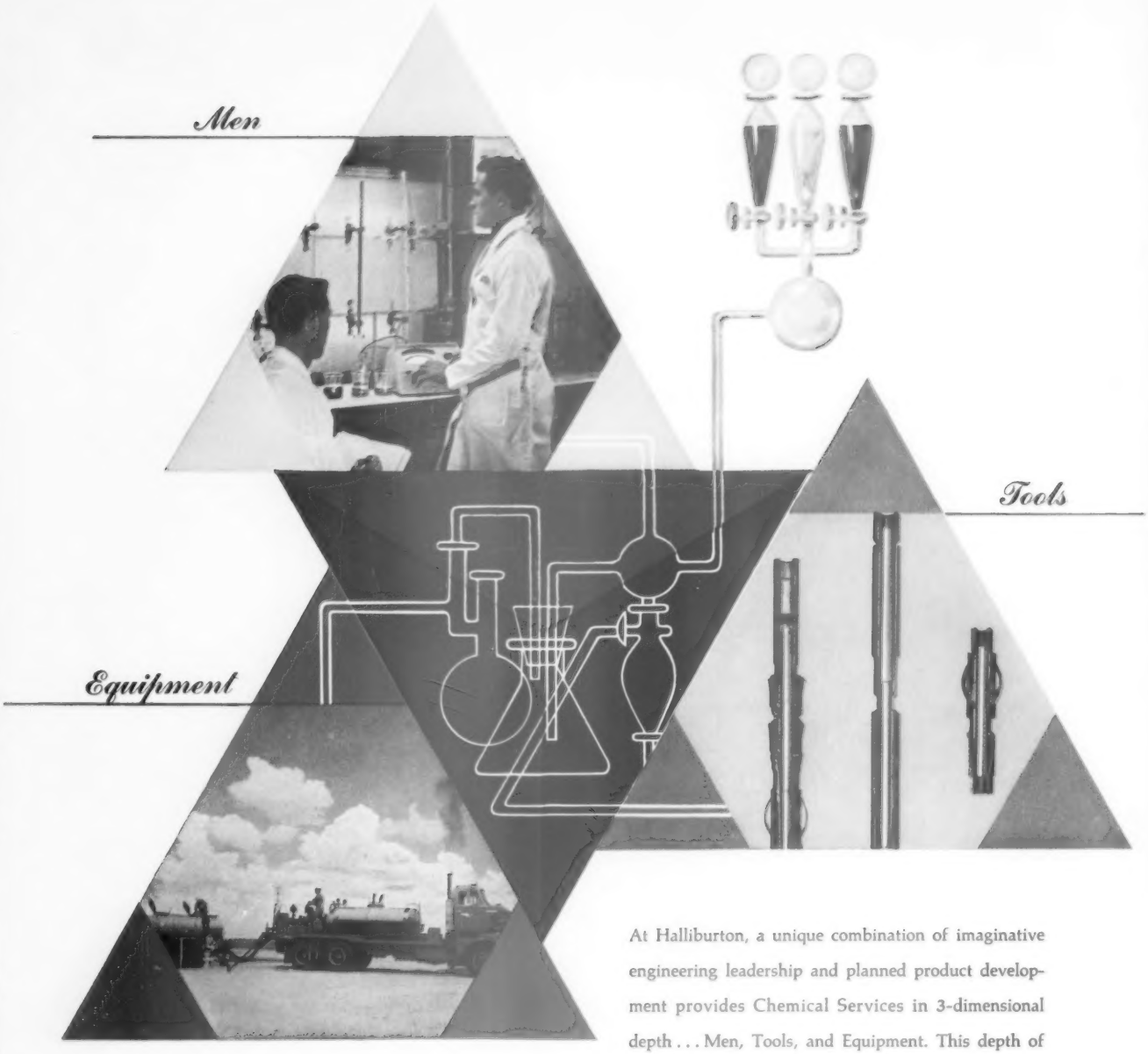
How Sun Oil mines and operates LPG storage caverns

p. 88

Special Construction Report:

Petrochemical Expansion is Skyrocketing

. . . details p. 66



3 DIMENSIONAL CHEMICAL SERVICE

At Halliburton, a unique combination of imaginative engineering leadership and planned product development provides Chemical Services in 3-dimensional depth . . . Men, Tools, and Equipment. This depth of service combined with over 35 years of experience has made Halliburton the first choice of thousands of operators throughout the world.

With customer service as its primary goal, and without obligation to any one brand of chemical products, Halliburton devotes its research and service energies to the specific task at hand . . . the very best suggested well treatments at the lowest possible cost.

Halliburton COMPANY
DUNCAN, OKLAHOMA

OIL AND GAS JOURNAL
Vol. 59, No. 21

Contents May 22, 1961

THE WEEK'S NEWS

General Interest:
NPC Completes Crude-Oil Productive Capacity Survey ... 41
Jersey Uses Higher Math to Solve Operating Problems ... 42
TIPRO Eases Stand on Texas Spacing Rules ... 46
Coal Seeks Independents' Help Against Fuel Imports ... 46
Justice Department Challenges Conoco's Malco Refineries' Lease ... 49
Producers Still Don't Agree on Merits of Area Pricing ... 50
Wilderness Bill Is Attacked by API Official ... 58
Domestic Producers Will Fill New Energy Demands During Decade ... 59
Texas Sets 8-Day June Allowable ... 60

Processing:
Aromatics Outlook Calls for Surplus, But No Glut ... 39
Boom in Permian Basin Petrochemical Production Predicted ... 44
Gulf Expands Petrochem Facilities, Announces New Process ... 57

Marketing:
Gulf Moves Toward Automated Credit-Card Business ... 41
Mobil Sells Economy and Reaps Publicity Bonus ... 48
Jobbers Fume Over Pricing Policies ... 54
Fuel-Oil Men Resent Competitors' Tactics ... 55
American Finds Changing a Name Runs Into Work ... 57

Pipelining:
Canada-to-New York Crude Line Planned ... 58
Sale of Offshore Louisiana Gas to TGT Nears Completion ... 58
Pipeline Briefs ... 60

Foreign News:
Cheap Soviet Oil Gains Markets in Japan ... 62
Oasis Has New, Big Libyan Discovery ... 63
Two Discoveries Brighten Gabon's Oil Picture ... 63
Libyan Pipeline Project Clears Last Hurdle ... 64
Saudi Arabia Adds Big Oil Reserves ... 64

Exploration:
Dry Hole Breaks Soldotna Creek's Perfect Record ... 40
Drilling Is Pushed in Promising Alberta Fields ... 45
Two Big Discoveries Made on Texas-Louisiana Gulf Coast ... 61
Two Gas Strikes Put Texas' Edwards County on Producing Map Again ... 115
Geology Curriculum Changes to Meet New Conditions ... 116

REGULAR FEATURES

Advertisers' Index ... 149
Calendar of Events ... 31
Classified Advertising ... 146
Deaths ... 140
Drilling Contractors ... 111
Drilling Statistics ... 142
Editorial ... 37
Equipment Men ... 105
Exploration Highlights 115
Foreign News ... 62
Foreman's Page ... 91
Journally Speaking ... 35
Markets ... 145
New Equipment ... 97
Personals ... 138
Production ... 143
Refining Statistics ... 144
Statistical Summary ... 141
Technical Questions ... 81
The Journal Said ... 35
They Say ... 27
Trade Literature ... 103
Watching Washington ... 47
Who's Who in Oil ... 135

Technology-Operation section on next page →

The Oil and Gas Journal is published weekly by The Petroleum Publishing Co., 211 S. Cheyenne, Tulsa 3, Okla. Second-Class postage paid at Tulsa, Okla. Copyright 1961 by The Petroleum Publishing Co. United States and foreign rates to the petroleum industry, 1 year $6, 2 years $9, 3 years $12.

TECHNOLOGY—OPERATION

Refining-Processing

Petrochemical Construction is Skyrocketing 66

By Robert B. Bizal

Capacity is growing fast. New Journal survey lists more than 120 projects under way or planned in the U. S. and Canada. Aromatics, polyolefins, and olefins are getting big play. Gulf Coast is hot, but activity is also high in the Midwest and eastern states.

Dow's New Benzene-Recovery Unit 73

Regenerating Zeolites Used for Sulfur Removal 78

By Harry W. Haines, Jr., G. A. Wielingen, and F. B. Mathews

New process uses synthetic zeolites as Claus catalysts. Catalyst properties permit simultaneous dehydration and sweetening of natural gas, direct conversion of the adsorbed hydrogen sulfide to elemental sulfur.

Questions on Technology 81

Is reforming feasible for 100-octane production?

How Sun Mines and Operates LPG Storage Caverns 88

By Pat Dougherty and Gilbert J. Fenix

The company will take light hydrocarbons directly from refinery units to storage, and will use deep-well pumps to recovery them.

The Foreman's Page 91

Air-cooled heat exchangers may be economical.

Statistics Solve an Inspection Problem 92

By W. P. Shontz

Refinery inspections are gradually replacing guesswork with statistics. Through this method data points can be preselected rationally. Although there have been risks in inspection work, the risks can now be put in quantitative terms.

Pipelining

P.D. Meters Work in Pipeline Terminal 70

By G. S. Schonewald

Seventeen months of operation on the Portland-Montreal Pipe Line System have proved that deliveries to refinery tankage are made more efficiently.

Drilling-Production

New Ton-Mile Tables Extend Wire-Line Life 74

By R. G. Dull

Compiled from electronic-computer data, these help the driller get longest possible service from the rig's wire line. Resulting cutoff and line-slippage program will keep wear from concentrating in any one spot.

Drilling with Air-Foam Aerated Fluid 82

By Robert Willborn

Delta Drilling Co. drills faster in West Texas with foam and aerated fluid than with mud. Rates are not quite as fast as when drilling with air alone.

Oil-Well Pumping—42 84

By Joseph Zaba

Multizone rod pumping.

Reservoir Engineering—37 86

By E. T. Guerrero

How to determine performance and ultimate recovery by exponential decline-curve analysis.

THE OIL AND GAS JOURNAL **Newsletter**

May 22, 1961

October hearing on Permian basin appears likely in FPC's grapplings with **area-price approach** to natural-gas problems.

Hearing would cover general economic data only, not the basic issue of what cost information would be required.

Note that agency plans to issue an interim order setting prices for southern and offshore Louisiana natural gas, pending outcome of area-price hearings there.

This is tacit admission that FPC can't leave price question up in air for 3 or 4 years while attempting area approach.

Good bet in Washington: **New director** of Interior Department's Office of Oil and Gas will be named soon—possibly within a **week or 10 days.**

▼ ▼ ▼

There's encouraging news for oil men fighting to save the billion-dollar-plus oil-change market.

Gas-oil ratio, which has been sliding for 10 years, now appears to be **leveling off.** This coincides with successful efforts of an API task force to inform motorists that it's to their own selfish interests to change motor oil frequently.

For gasoline men, motorist-motivation study by Ethyl holds promise. It proves cost of gasoline is **not a major factor** in determining how much motorists will use his car. And **just as important:** People do enjoy driving.

▼ ▼ ▼

Cold attitude of independents toward President Kennedy's proposal to exempt from direct control all gas operators who produce less than 2 billion cubic feet a year might warm up if cutoff point were raised.

There was more than a little sentiment for such a raise—perhaps to 10 or 20 billion cubic feet—behind the scenes at recent TIPRO meeting in Midland.

Views like this, coupled with Massachusetts Rep. Torbert Macdonald's flat statement that "there is nothing sacred about the 2-billion-cubic-foot figure" in his bill, could foreshadow a possible industry split.

Direct-drive **steam turbine-compressor combinations** in the 11,000-r.p.m. range are coming into wider use.

Compressors in the 20,000-r.p.m. range are available, too, but direct-drive combinations in this category await suitable drivers.

Good progress is reported in American Gas Association experiments on **storing of liquefied methane** in buried tanks.

Research on how various frozen soils affect storage tanks is near completion. Point already proved: Liquefied methane can be stored at —250° F. in above-ground tanks.

▼ ▼ ▼

Strong note of **hope for business upswing** is sounded by National Association of Credit Management.

Group says consensus view of its **35,500 credit and financial executives** reflects feeling of optimism.

Some details of an NACM forecast:

Rest of 1961 and all of 1962 will see renewed expansion of national economy, **carrying business to record levels.**

Barring international disaster, growth will continue for years.

Productivity, and with it the average real income of all in U. S., will rise by perhaps 25% during this decade.

Oil companies are still concerned over **conflict of business interests.**

One major's asking its 300 management men to fill out a form which **gives details on business dealings** and investments. Company hopes to spot possible conflict situations.

Aim of the survey is to protect the executives themselves, reassure stockholders, and safeguard public confidence in business.

▼ ▼ ▼

Wyoming's first big discovery of year, McCulloch Oil of California's 1 Government-Gentry in Campbell County, assures northernmost pre-Cretaceous production in Powder River basin.

Well **swabbed 38 bbl. per hour** during tests from perforations at 5,382-86 ft. in Minnelusa Pennsylvanian. Nearest Minnelusa production is at Pownall Ranch field, 21 miles southwest.

Find **opens entire new region** in the state and basin.

Wildcatting notes: Count shows dozen active Lower Cretaceous wildcats in Mississippi, **more than in many months.** Couple of years ago nearly all wildcats in state were going to Lower Cretaceous, but this deep trend has been quiet since flush development of Lower Tuscaloosa zones at Little Creek and McComb fields. Latest spurt of activity **may signify return of major interest** in the pay.

Remote wildcat in southeast corner of Texas Panhandle **could open first production** in a section of eastern Palo Duro basin. Well is R. D. Gunn 1-A E. V. Perkins, 3½ miles southeast of Kirkland Township in Childress County. **Recovery on drill-stem test** in Cisco Penn lime at 4,588-99 ft. was 900 ft. free oil and 300 ft. of mud-cut oil.

Geophysical activity **continues to decline** in U. S. and Canada.

Preliminary figures by Society of Exploration Geophysicists show **8% drop for U. S.** in 1960 and **18% drop for Canada** compared with 1959.

U. S. racked up only 5,206 crew months last year against 5,696 in 1959. Canada fared even worse, with 686 crew months in 1960 compared with 841 the year before.

▼ ▼ ▼

Look for hydrocracking to come into general use in refineries during next few years.

Move will be **more of an evolution** than a revolution. As refiners map new capacity to cope with upsurge in demand, they'll give serious consideration to hydrocracking as adjunct to existing cat cracking capacity.

It's not likely that many hydrocrackers will supersede cat crackers, but in long run this could happen.

Key to success of hydrocracking lies in cost of hydrogen.

Promising avenue to **improved cat cracking** lies in reduction of metals in feed stocks.

You can **expect new developments**—possibly this year—in pretreating of cat feeds to reduce metals and thereby reduce coke and gas make.

▼ ▼ ▼

New role for mobile process-data-logging equipment is in the offing.

Equipment has long been used for **passive recording of process variables.** Now there's a trend to exercise some process control from the mobile unit, with object of **finding process dynamics.** Aim: Translating results into dynamic mathematical models for use in computer control.

One way to tackle problem of **berthing new supertankers** at many oil terminals: **Lightering** with T-2 tankers.

Approach is being used in some cases. However, long-range prospect calls for major offshore terminals designed to handle the behemoths.

Long look ahead: Coal and shale may zoom past crude petroleum as major primary sources of fuel within next 100 years.

Prediction was made by Martin A. Elliott, director of Institute of Gas Technology, before ASME group in New Orleans. His thinking: Processes are available for converting coal and shale to liquid fuel or to high-B.t.u. gas, and resources of the two materials are more than adequate for many decades.

Coal and shale are no cinches for star billing by mid-21st Century, however. Developments that could hold them back: Use of nuclear energy, better methods of recovering oil and gas, discovery of new fuel resources, perfection of such devices as fuel cell.

▼ ▼ ▼

Chance that Pan American International (Indiana Standard) is ready to **make a deal to hunt oil** in Egypt's Western Desert looks strong.

Company officials will say only that they are negotiating with Egypt. But Cairo reports indicate Pan Am has offered Egyptians a half interest in an operating company, as company did to obtain an offshore concession from Iran.

Market memo

May 22, 1961

Pricing confusion is giving the oil industry a public-relations black eye.

Marketers at API meeting in Miami Beach report:

Three successive **heating-oil price increases** at the height of winter on East Coast stirred up more than usual number of **customer complaints.** Customers can't understand why so many boosts were needed.

Other gleanings from Miami Beach:

Talk in fuel-oil circles centers around possibility of a guaranteed ceiling, of **larger but fewer price jumps** when needed, of discontinuing summer allowances.

Gasoline retailers have some doubts that **area pricing** is going to do the job in **preventing price wars.** Jobbers complain it only reduces their margin. They say companies **need to end practices** which often find them undercutting their own jobbers and dealers on price.

About all you can prove: Competition to get customers is tougher.

▼ ▼ ▼

Two weeks after Sun **began selling nine grades of gasoline** in Charlotte, N. C., with the lowest grade priced the same as private-brand regular, the East Coast market is in the throes of **one of its bitterest price wars.**

Retail prices at service stations have dropped 10 cents to 21.9 cents a gallon for regular major brands. Dealer tankwagon price fell 9.3 cents.

By middle of last week, Esso—the dominant marketer—had dropped its net dealer price to 6.5 cents.

Under Esso's area-pricing system, **cuts have been spread** as far as Charleston, S. C. Net dealer prices range from 8.5 cents at Greensboro on fringe of Charlotte market to 14.1 cents in Charleston.

▼ ▼ ▼

Glances at pricing: Group 3 spot gasoline is freely available at 11.50 cents a gallon and can be found in some areas at 11.25 cents. At this time last year, Group 3 regular was down to 10.50 cents a gallon, but had climbed to 12.25 cents by mid-August. Refiners hope demand will be strong enough to push price up a little this summer.

Spot prices for light fuels in Chicago are off 0.25 cent a gallon, with No. 2 now at 8.75 cents a gallon. This leaves delivered-Chicago price only 0.25 cent above Group 3 quotations.

Kerosine and light-distillate prices are off about a cent a gallon in South Atlantic states. Cut follows reductions on Gulf Coast and in North Atlantic states.

The sloppy retail market in California shows signs of firming. Standard of California has moved up gasoline prices in the Bay area, and other majors have indicated they may follow suit. Recently, a 3-month-old price war in Los Angeles ended.

Bovaird Now Sells

TUBE-TURN® *Welding Fittings and Flanges*

SUPPLY BOVAIRD COMPANY

COMPLETE STOCKS OF TUBE • TURN PRODUCTS NOW AVAILABLE THROUGH OUR 28 OFFICES AND STORES

Buy From

PESA

THE Bovaird SUPPLY COMPANY

GENERAL OFFICES TULSA, OKLAHOMA

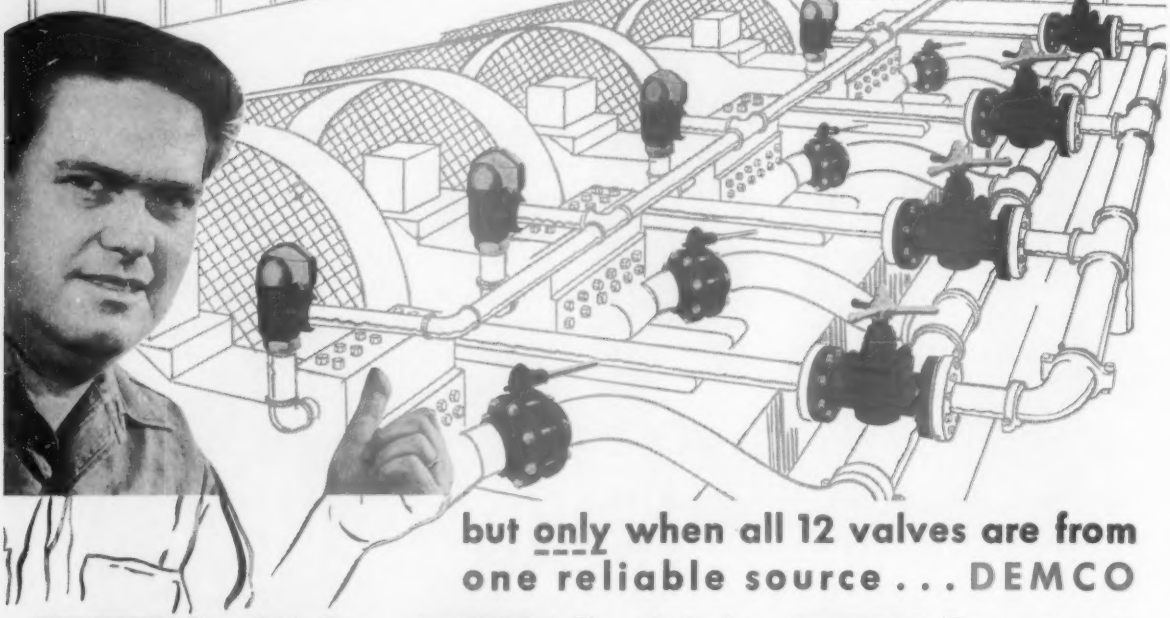
90 YEARS OF PROGRESS WITH THE OIL INDUSTRY

OFFICES AND STORES

COLORADO—Denver
ILLINOIS—Carmi, Salem
KANSAS—Chase, Great Bend, Liberal, Pratt, Russell, Wichita
LOUISIANA—New Iberia, Shreveport
MISSISSIPPI—Natchez
NEW MEXICO—Farmington, Lovington
OKLAHOMA—Duncan, Oklahoma City, Pauls Valley, Sapulpa, Tulsa
TEXAS—Amarillo, Borger, Colorado City, Dallas, Houston, Midland, Odessa, Pampa

equation for efficient operation:

3×4=1



but only when all 12 valves are from one reliable source . . . DEMCO

Dependable Demco Safety Relief Valves provide maximum protection against excessive pump and line pressures and offer the ultimate in safety to workers. Built-in safety cap encloses shear bar and nail, yet opens instantly when line pressure shears the nail. Advanced Demco design insures immediate relief from excess pressure by use of a *single* nail for *all* relief settings on the shear bar. Available in standard cast steel valve and sub-assembly or non-corrosive bronze valve with stainless steel sub-assembly.

The exclusive features of Demco Butterfly Valves offer bubble-tight seals in pressure or vacuum applications for liquids, vapors, or solids. The Demco disc "floats" on the stem, without set screws or exterior fastenings, and finds its true center for a positive, non-directional shut-off. A one-piece Buna-N seat, bonded to steel, provides a stronger, larger contact area for disc, acts as stem packing and eliminates needs for gaskets or "O" rings between flanges. Only the Buna-N synthetic seat and corrosion-resistant metal disc are exposed to line flow. Factory tested in excess of working pressure, Demco Butterfly Valves offer quick in-line repair.

You can count on longer, trouble-free valve life—and, a *drop-tight* seal every time—with the rugged, corrosion-resistant Demco Gate Valve. Exclusive spread-ring seat construction gives you a *positive* rubber-to-metal seal without undue stem torque—durable, synthetic Buna-N against corrosion-resistant stainless, Monel, aluminum bronze or steel. Entire inner assembly lifts out for faster, easier *in-line* inspection. With Demco's unique design, fewer parts are subject to wear. Stem threads are self-lubricated and protected from corrosion by a *double* stem seal.

Wherever durability, reliability and safety are essential, on drilling and production installations all over the world, rugged Demco Valves have proved to be the answer. Choose all three or just one—but choose Demco!

All valves available in popular sizes and pressures at supply stores everywhere. Write Demco today for complete engineering details!

DRILLING EQUIPMENT MANUFACTURING COMPANY
834 S. E. 29th Street • Oklahoma City, Oklahoma

"PUMPING EFFICIENCY INCREASED NEARLY 100%"

TUBING TENSION ANCHOR

TUBING ANCHOR-CATCHER

Major Company credits Halliburton Tubing Anchor-Catcher for these successful results:

"Ninety percent of the wells were using 2 in. tubing and pumping from 1,000 ft. to 1,500 ft. off bottom. On four different occasions our tubing parted while pumping and coming out of the hole, and the Tubing Anchor-Catcher prevented costly fishing jobs on each one. We have experienced less wear on our tubing and rods, and have found the corrosive resistant feature of this tool to be quite satisfactory."

The above is a statement of successful results attributed to Halliburton's Tubing Anchor-Catcher by a major oil company who, like many operators, have found that anchoring tubing in tension helps:

- Increase pump efficiency by reducing restrictions on plunger travel
- Reduces wear on rod and tubing couplings and threaded connections in the pump
- Increase pumping unit and rod life by reducing peak-torque reversal loads
- Reduces tubing stretch thereby lessening breathing and buckling of string.

ANCHORS TUBING IN TENSION AND CATCHES TUBING IF IT SHOULD PART

Made up in the string just above the pump, the Halliburton Tubing Anchor-Catcher offers the plus feature of catching the tubing by reverse action of the slips in the event it parts, thus helping to prevent a costly fishing job.

In the well, a ¼ turn of the tubing sets the tool's slips anchoring the string enabling it to be pulled into tension.

HALLIBURTON TUBING TENSION ANCHOR

This economical tool anchors the tubing providing the benefits of producing wells with tension anchored tubing as noted above. Setting tubing weight down automatically re-jays the tool and retracts the slips to pull the string.

SEE YOUR HALLIBURTON MAN for more information on these two advanced products. Specific details will be found in Brochure No. S-8031 . . . call today!

275 Service Centers

. . . Just minutes away

from your well!

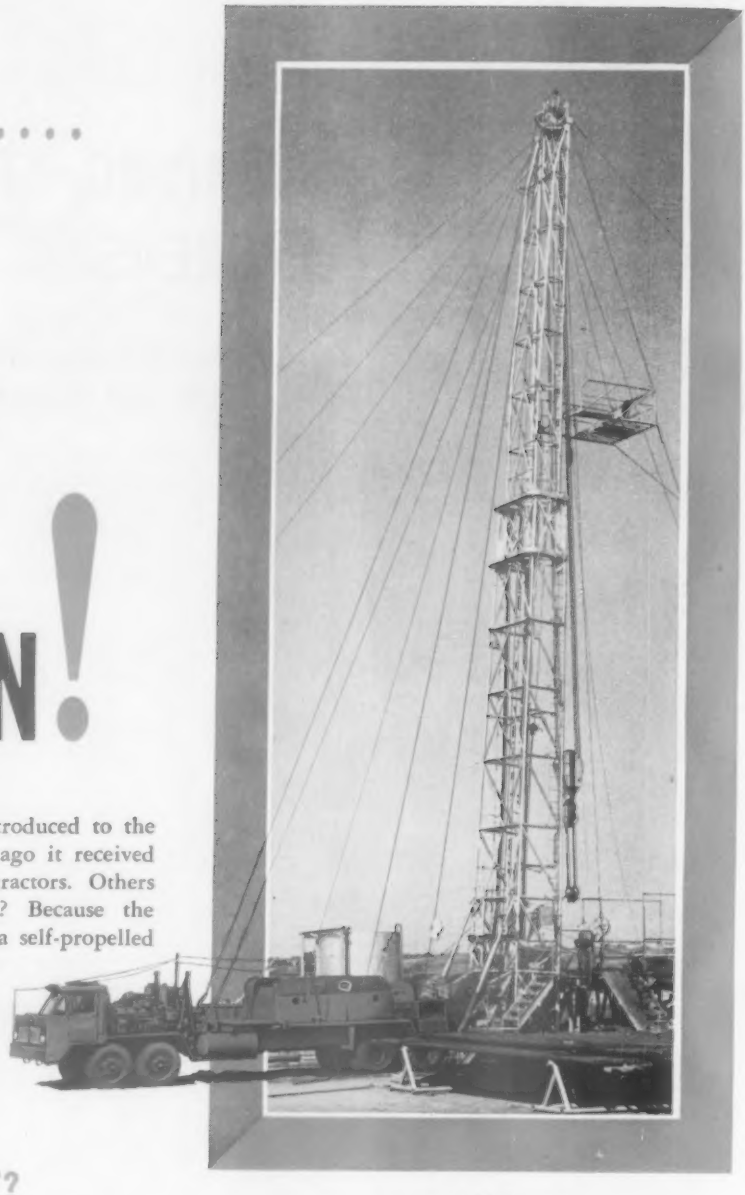
PRODUCTION TOOLS

Halliburton

COMPANY • DUNCAN, OKLAHOMA

Franks Explorer....

NOW FULLY FIELD PROVEN!



When the Franks Explorer was first introduced to the well servicing industry some two years ago it received immediate acceptance from many contractors. Others assumed a wait-and-see attitude. Why? Because the Explorer was a totally new concept — a self-propelled unit primarily designed as a servicing and workover rig, and mounted on a rugged carrier for secondarily designed to over the road travel. Here was the promise of new speed, more horsepower, greater flexibility. The "wait-and-see" groups settled back to watch.

AND WHAT DID THEY SEE?

Within two short years they saw the Franks Explorer outsell all competition. They saw themselves joining that first group of contractors who accepted the Explorer immediately — who knew Franks' reputation for building good equipment and for delivering what is promised.

If you're still from Missouri, ask the man who owns a Franks' Explorer. Or, better still, call your Franks' representative for all the details.

WELL SERVICING AND DRILLING UNITS

FRANKS

PAMPA, TEXAS

CABOT

CABOT CORPORATION
MACHINERY DIVISION

Worth more when you BUY 'EM . . . Worth more when you TRADE 'EM

90-inch seven-stage bit used by Kerr-McGee Oil Industries is the business end of an installation which includes the Allen-Sherman-Hoff materials-handling centrifugal pump. Pump is lined with Hycar molded by A-S-H Molded Products Company. B.F.Goodrich Chemical Company supplies the Hycar nitrile rubber.

Hycar lined pump delivers 8,000 gpm of mud to giant-sized rotary drill

Oil field technology is giving a boost to another industry—mining—with this tremendous rotary drill. It is excavating a 90″ hole 700 feet deep, equivalent of moving earth from a 12″ hole 40,000 feet deep.

Providing a continuous mud supply is a real job—the centrifugal pump being used has a rating of 7,000 gpm with a discharge head of 110 feet. Up to 8,000 gpm are obtained in operation. The pump is lined with Hycar nitrile rubber—chosen to protect the pump housing against the torrent of sharp rock chips carried by the mud circulated during the drilling operation.

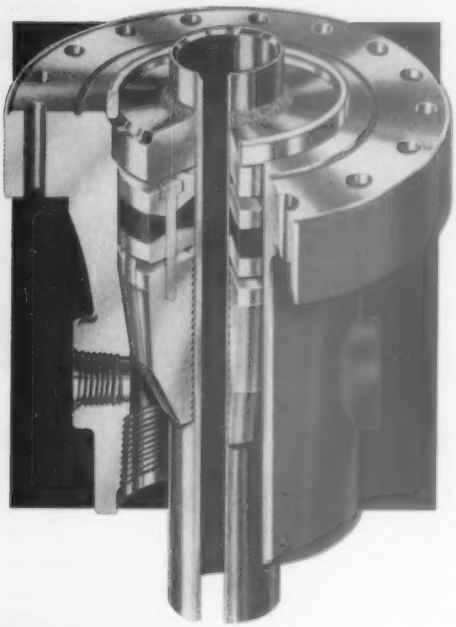
Hycar is often the choice for oil field jobs—it performs excellently under both high and low temperature conditions, it resists corrosion, chemicals and hydrocarbons in a manner unmatched by other rubbers. It will pay you to see that Hycar is used in all your operations. For more information, write Department MF-4, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. In Canada: Kitchener, Ontario.

B.F.Goodrich Chemical
a division of The B.F.Goodrich Company

Hycar
Rubber and Latex

Rector M-4

A low-cost casing head designed for positive trouble-free completions



The Rector Type M-4 casing head is a simple and compact head, designed especially for the safe, economical completion of any medium pressure range well.

The Rector M-4 seals permanently, without the use of resilient packing. It carries a restricted ring groove for final setting which upgrades the working pressure of the flange connection to the next higher rating, permitting connection of the next higher pressure rated tubing head without the use of cross-over flanges.

The Rector M-4 flange has a standard A.P.I. ring groove for attachment of drilling control equipment and is furnished with a removable drilling protector ring.

For economy and dependability choose a RECTOR M-4 casing head for your next completion. Available through your favorite supply store or your RECTOR representative.

30 YEARS MAKING THE OIL INDUSTRY SAFER

Rector

WELL EQUIPMENT CO., INC.

Making the Oil Industry Safer!

1100 North Commerce, Fort Worth, Texas
Houston Plant: 2215 Commerce Street

PESA PARTNERS IN PETROLEUM

MONOGRAMMED EQUIPMENT CERTIFICATE NO. 2158

EXPORT REPRESENTATIVES: CONTINENTAL-EMSCO CO., MID-CONTINENT SUPPLY CO., OILWELL DIVISION OF UNITED STATES STEEL CORPORATION

YOU SAVE WHEN YOU DO BUSINESS WITH

CONTINENTAL-EMSCO

it takes GUTS to drill today!

It takes *guts* in slush pumps, too. That's why Continental-Emsco builds this power end to take emergency loads in stride.

Continental-Emsco *stabilized* slush pump design *ten years ago* with its Fabriform construction! And ever since, Continental pumps have set an unequalled record for long life. This is verified by the few spare parts being ordered as compared to the number and age of pumps now running.

Continental slush-pump design reflects years of performance under all kinds of drilling conditions . . shallow to great depths . . light to heavy mud loads . . slow and fast rotating speeds . . light to heavy drill collar loads.

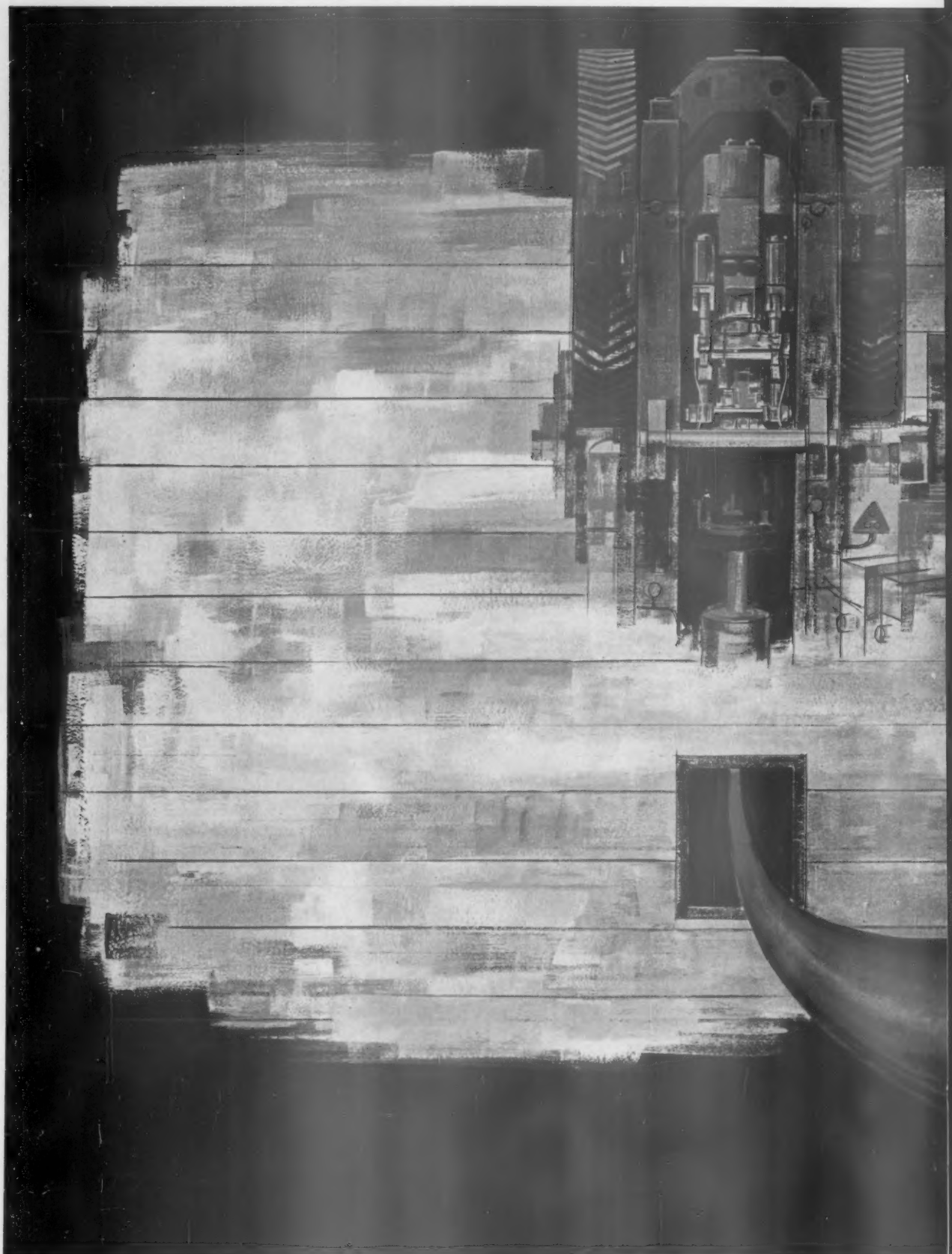
If you want real back-up for your courage to face today's tough drilling contracts, call a Continental man and talk slush pumps.

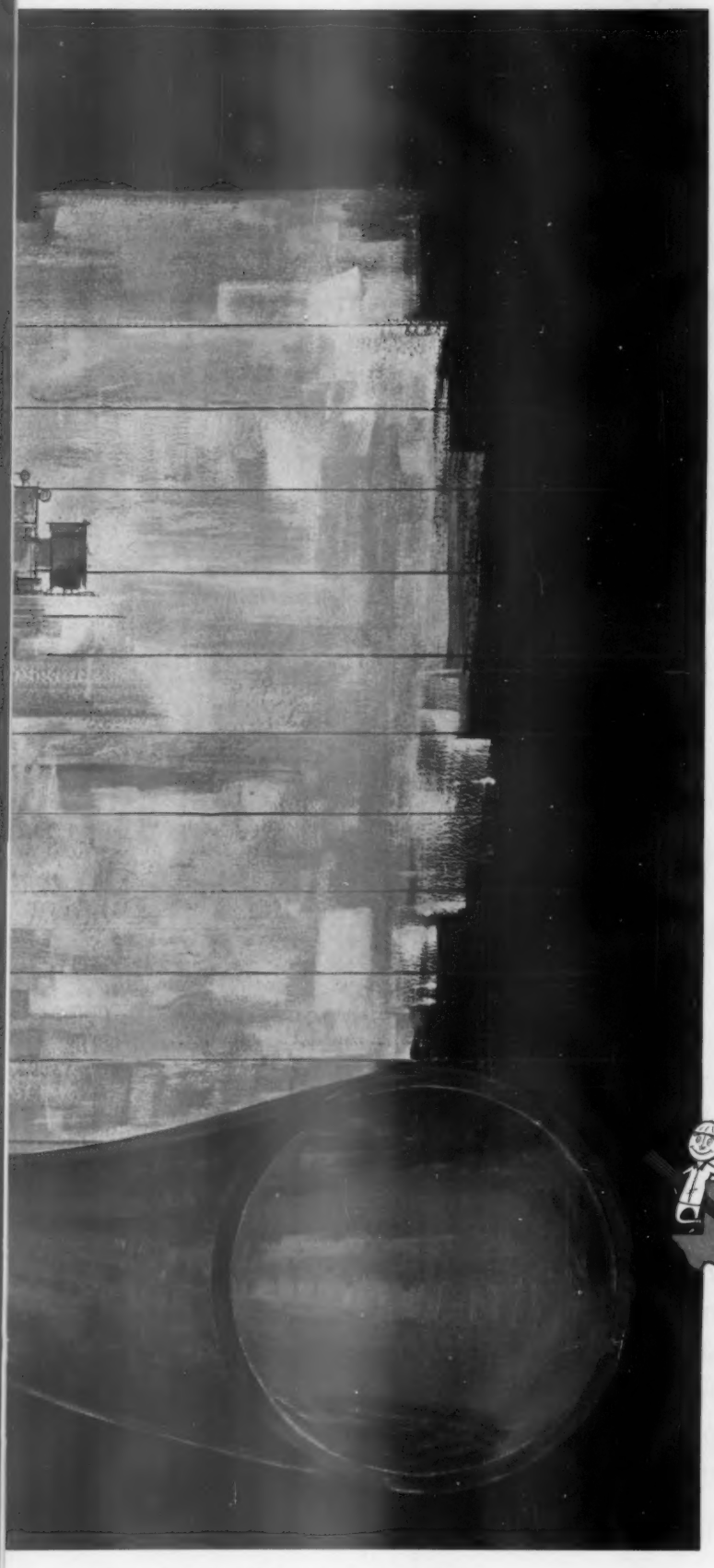
CONTINENTAL-EMSCO

Serving the Oil and Gas Industries . . Worldwide

SP 102

CONTINENTAL-EMSCO COMPANY, a Division of The Youngstown Sheet and Tube Company, General Offices: Dallas, Texas; Export Division: 30 Rockefeller Plaza, New York, N. Y. • Continental-Emsco Company Limited, General Offices: Calgary, Alberta, Canada Continental-Emsco Company C. A., Caracas, Venezuela • Plants: Houston and Garland, Texas; St. Albans, Herts, England • *Representatives in All Principal Oil Fields of the World*





New Mill

New Tubing Availability

BACKED BY MORE THAN 33 YEARS' EXPERIENCE

Announcing the installation at Gulf States Tube Corporation of the world's first and only fully automatic mechanical vertical extrusion press and in-line hot finish mill for the production of seamless steel tubing.

The new facilities will double the production capacity of Gulf States, making available 45,000 tons annually of the highest quality tubing in a wide range of alloy steels, including stainless.

Tubing sizes to be produced in the new mill range from approximately 1 inch to 2⅜ inches with lengths up to 110 feet in the smaller diameters.

SALES OFFICES

Atlanta, Georgia • Boston, Massachusetts • Buffalo, New York • Chicago, Illinois • Cincinnati, Ohio • Cleveland, Ohio • Denver, Colorado • Detroit, Michigan • Houston, Texas • Los Angeles, California • Philadelphia, Pennsylvania • Pittsburgh, Pennsylvania • St. Louis, Missouri • Seattle, Washington • San Francisco, California

GULF STATES TUBE CORPORATION

A Specialty Mill Producing High Quality Seamless Steel Tubing

Rosenberg, Texas **Teletype 438**

Phones

Rosenberg: NO 2-2856 **Houston: CA 8-9656**

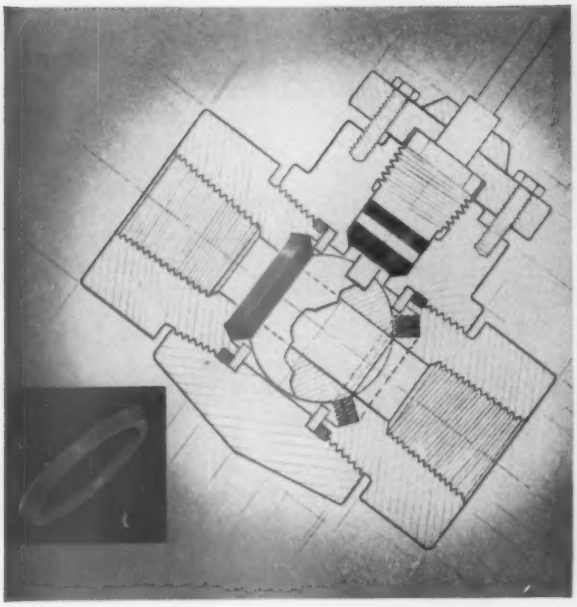
Subsidiary of Michigan Seamless Tube Company

South Lyon, Michigan

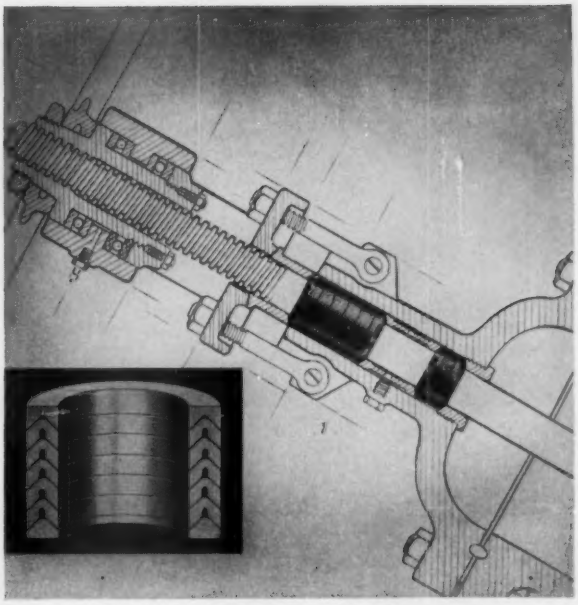
- ***Macaroni Tubing***
- ***Pressure Tubing***
- ***Condenser & Heat Exchanger Tubing***
- ***Mechanical Tubing***
- ***Aircraft Tubing***

Texaco in Dakar, West Africa, is an investment in progress—and in people. The man with the air hose is busy with a "customer". He is D. Magatte, a Texaco Dealer proud of his reputation of giving the best service in town. And Texaco is proud and fortunate to have men like D. Magatte representing them in many parts of the world. Texaco's own progress is built on helping others to develop new skills and personal security. As a major producer, refiner and marketer of oil, Texaco is contributing to the economic stability and to the growth of countries throughout the Free World.

TEXACO: SYMBOL OF WORLD-WIDE PROGRESS THROUGH PETROLEUM



Seats and stem gaskets of TFE resin assure tight-sealing, no-stick operation in these non-lubricated ball valves used in high-pressure butane-propane service. These valves have been in operation for three and one-half years, with no leakage or valve failure.



V-ring packings of a TEFLON TFE resin in valves for paper-mill service eliminate the frequent changes of packing and periodic adjustments formerly required. In addition, losses of corrosive liquor are eliminated and wear on valve stems is sharply reduced.

Maintenance and replacement costs reduced with packings and gaskets of TEFLON® TFE resins

The two examples above typify the cost-cutting advantages of TEFLON fluorocarbon resins as packing and gasket materials. In all applications TEFLON resins provide long service life . . . with resultant savings in maintenance and replacement costs, plus increased productive capacity due to less downtime. TEFLON resins are not affected by materials being processed. Their low-friction characteristics often permit their use without lubrication, minimize torque requirements, and reduce wear on pistons and shafts.

TFE resins are the established standards where reliability over a wide range of severe conditions is important. They are rated for continuous service at 500°F. FEP resin is the new melt-processible member of the family of TEFLON fluorocarbon resins. It can be molded and extruded like nylon, polyethylene and other familiar resins. FEP resin is capable of continuous service at 400°F.

In many applications, TEFLON fluorocarbon resins have been found to be the only material that would give satisfactory performance. But even when service demands are not exceptionally rugged, the properties and versatility of TEFLON TFE and FEP resins permit plant-wide standardization for packings and gaskets in petrochemical service.

For more information about the wide variety of forms in which TFE and FEP resins are available for sealing applications, consult your supplier. And for additional information about properties and characteristics of TEFLON resins and the many ways they have led to improved, economical designs, write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department OG-522, Room 2526T, Nemours Building, Wilmington 98, Delaware.

• • •

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

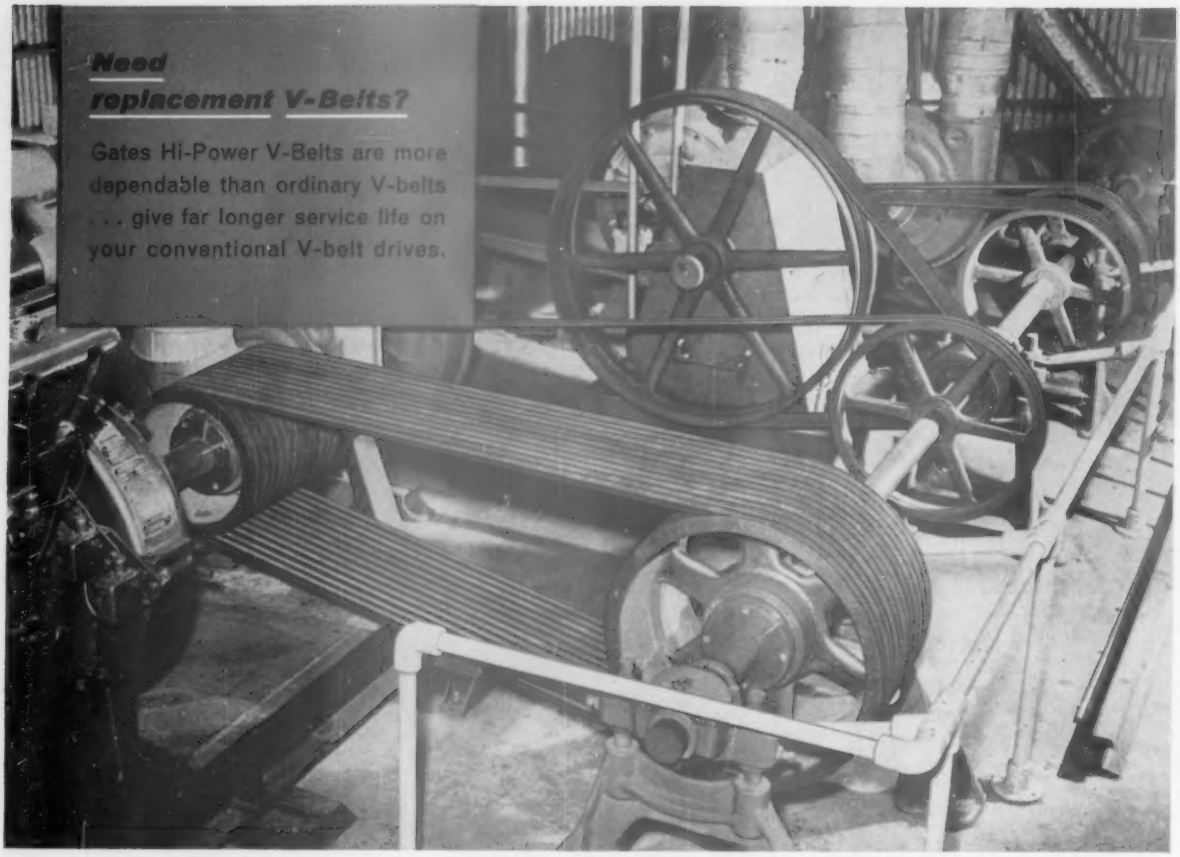
DU PONT REG. U.S. PAT. OFF.

TEFLON®

FLUOROCARBON RESINS

TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resin.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY


Need replacement V-Belts?
Gates Hi-Power V-Belts are more dependable than ordinary V-belts . . . give far longer service life on your conventional V-belt drives.

Why Gates Hi-Power V-Belts are industry's No. 1 choice for replacement belts

There are several important reasons why Gates Hi-Power V-Belts are preferred by most industrial V-belt users today.

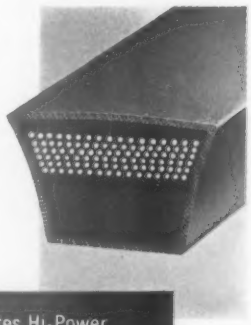
The exclusive construction features of Gates Hi-Power V-Belts—Concave Sides (U.S. Pat. No. 1813698), Precisely-Engineered Arched Top, Flex-Bonded Tensile Member—make them more dependable than ordinary, conventional V-belts, giving you far longer belt life on even the toughest applications.

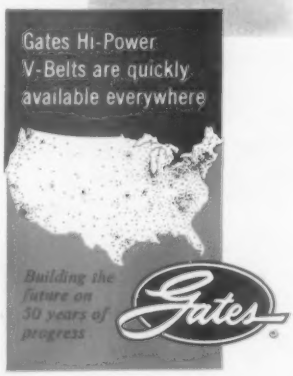
Moreover, because of Gates high standards of quality control, you get a perfectly matched set of Hi-Power V-Belts every time—every belt pulls its share of the load throughout the long service of the drive, further increasing belt life.

You get fast delivery from local stocks.

Oil field supply houses with stocks of Gates Hi-Power and Rib-Top V-Belts are located in all parts of the oil country, backed by Gates Service Centers in every major oil production area. This means that you can get replacement V-belts quickly.

The Gates-stocked supply house near you is a dependable source for most of your maintenance needs. Call them day or night for fast delivery of Gates V-Belts.





The Gates Rubber Company, Denver, Colorado BP40P

Gates Hi-Power V-Belts

SILICONE NEWS from Dow Corning

New Paint For Hot Spots

Silicone-based paints stay put ...resist corrosion, weathering

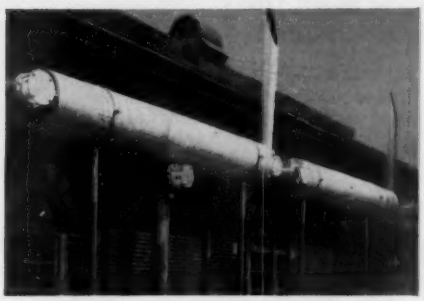
Guarding metal surfaces from weathering and chemical attack is tough enough. Keeping them protected when surface temperatures climb to 700 F, 800 F — even 1000 F — is tougher still. Most paints fail rapidly, blister and peel. But paints based on Dow Corning Silicones retain their protective properties, even on the hottest jobs.

Whether the surface stays hot, or shuttles between hot and cold, makes no difference to a silicone paint. Here's a new kind of protective coating . . . one that you can depend on to provide real protection, withstand oxidation, corrosive atmospheres or weathering. When paint lasts like this — from 25% to 100% longer — you save money because (1) less paint is required; (2) costly downtime and labor are greatly reduced.

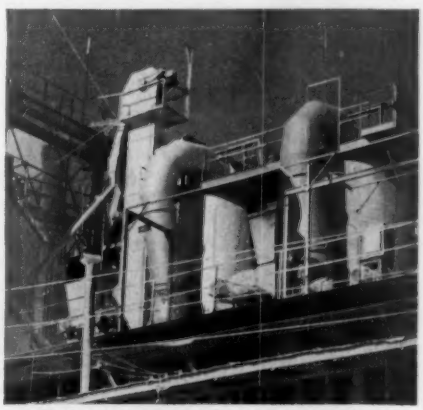
Another plus: Silicone-based paints are available in a wide range of colors. This means you can carry color-coding over onto hot equipment without worrying about early paint failure. To new product designers, this feature means finishes that resist chalking, checking, fading — retain their original beauty and protection.

For protecting a "hot spot" or a "hot product", it'll pay you to use paints made with Dow Corning silicone resins. Write today for more information.

"After 5 years, silicone paint still protects bronze-melting furnace. Organic paints failed within days after application."
BEARING MANUFACTURER



"After two years, mufflers coated with silicone paint are still in good shape. Organic paint used on similar 500 F mufflers burned away long ago."
PUBLIC UTILITY



"By far the most satisfactory paint we have ever used on kilns and stacks with surface temperatures of 650 to 750 F."
BASIC CHEMICAL MANUFACTURER

Send for illustrated brochure, "Why Silicone-Based Paints Mean Less Maintenance", plus list of suppliers. Address Dept. 6217.

first in silicones

Dow Corning CORPORATION
MIDLAND, MICHIGAN

ATLANTA BOSTON CHICAGO CLEVELAND DALLAS LOS ANGELES NEW YORK WASHINGTON, D. C.

Better Production Tools Through Research

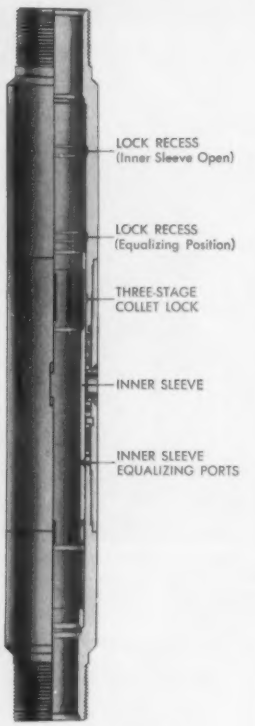
OTIS Equipment NEWS

Volume III, Number 1 Otis Engineering Corporation • Dallas *Production Equipment and Services*

Otis Sliding Side-Door Proves Most Versatile Circulating and Production Tool in the Field Today

Three Different Versions Solve Many Costly Production Problems

DALLAS — The Type A Otis Sliding Side-Door®, designed and introduced to the oil industry just four years ago, has become the most widely used selective circulating and production tool in the field today. Since its introduction, two modified versions — the Sliding Side-Door, with pump-out plugs and expendable shifting device, and the Sliding Side-Door Cross-Over — have been introduced.



TYPE A OTIS
SLIDING SIDE DOOR

© 1961 O.E.C.

The Type A Otis Sliding Side-Door is a full-opening tool designed to provide a selective means of establishing a flow course between the tubing and annulus without killing the well, moving the tubing or disturbing the packer setting. The tool is so designed as to permit any number of Sliding Side-Doors to be installed in a single string of tubing and any one or all opened or closed by wire line methods using a standard Otis Shifting Tool. When desired, the Type A Sliding Side-Door may be equipped with a special expendable shifting device and run into the well on the tubing in the opened position. This expendable shifting device serves to catch an aluminum ball or drop plug which is pumped down after circulating to close the sleeve.

Proven Design Features

According to the many operators using this equipment, there is an exclusive combination of features that makes the Otis Sliding Side-Door preferable for efficient well completion and economical production. These are: (1) Thoroughly proven in hundreds of wells. The design and mechanical operation of the tool has several years of operating proof behind it — the producer can use the Otis Sliding Side-Door with confidence. (2) Provisions for a positive indication that the sleeve is fully shifted. The standard Otis Wire Line Shifting Tool used to shift the sleeve of the Sliding Side-Door is designed to release itself only after the sleeve has been shifted to its fully opened or fully closed position. Equalizing ports in the sleeve serve to permit equalization of abnormal pressure differential while shifting the sleeve. (3) Outer sleeve design and construction combined with the clearance between the inner and outer sleeves serve to eliminate the metal-to-metal bind that makes shifting other tools often impossible. The Type A Otis Sliding Side-Door is designed to withstand the distorting forces of temperature, compression, tension or torque and still be shifted. (4) The flow area of the ports in the sleeve has proved ample for most applications.

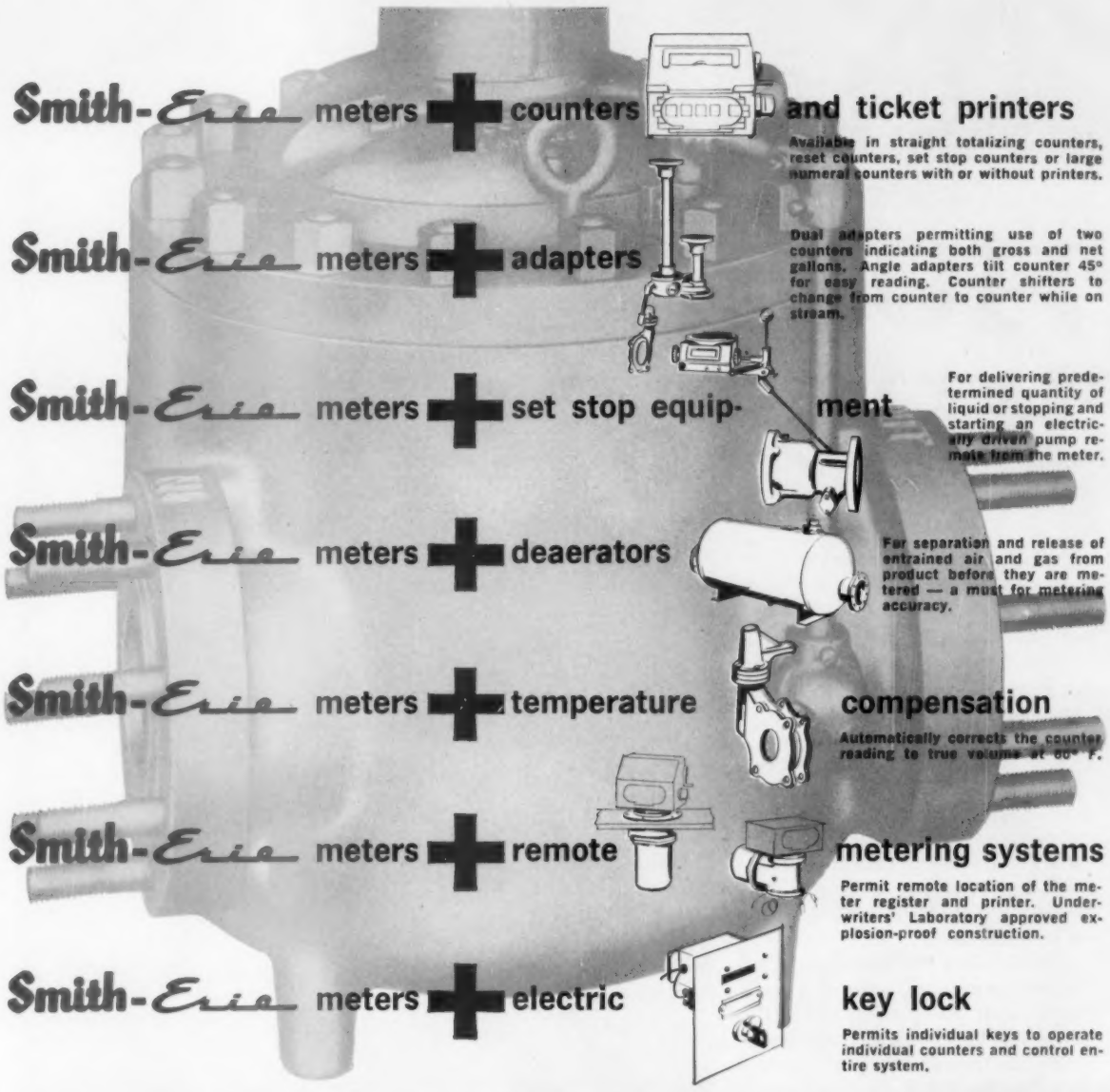
Versions for Special Application

A Type A Otis Sliding Side-Door with pump out plugs and an expendable shifting device is also available which has been designed to cut completion costs and provide additional blow-out protection in that it serves to permit high differential drillable packers to be tested and the tree nippled up before unloading the well.

Another version is the Otis Sliding Side-Door Cross-Over which is designed to provide for complete zone isolation while changing or removing cross-over chokes in single-string, dual completions.

All three Otis Sliding Side-Doors are available in a wide range of sizes — and all three Sliding Side-Doors are good examples of the cooperation of Otis' Well Completion Specialists and Engineering Staff in assisting operators to meet today's demand for economical well completion and production tools. Literally thousands of production problems have been solved by Otis over the past thirty years. Perhaps you are faced with a production problem Otis could help solve. If so, call your local Otis specialist today. For more information on Otis Sliding Side-Door equipment, call the Otis office nearest you or write Otis, Dept. E-1, P. O. Box 35206, Dallas 35, Texas. You'll find experienced Otis Well Completion Specialists ready to help you . . . anxious to serve you . . . and with the widest variety of field proven production equipment and services available today.

OTIS
Engineering Corporation
General Offices:
6812 Denton Drive • Dallas


Smith-Erie meters + counters
and ticket printers
Available in straight totalizing counters, reset counters, set stop counters or large numeral counters with or without printers.
Smith-Erie meters + adapters
Dual adapters permitting use of two counters indicating both gross and net gallons. Angle adapters tilt counter 45° for easy reading. Counter shifters to change from counter to counter while on stream.
Smith-Erie meters + set stop equip- ment
For delivering predetermined quantity of liquid or stopping and starting an electric-ally driven pump remote from the meter.
Smith-Erie meters + deaerators
For separation and release of entrained air and gas from product before they are metered — a must for metering accuracy.
Smith-Erie meters + temperature
compensation
Automatically corrects the counter reading to true volume at 60° F.
Smith-Erie meters + remote
metering systems
Permit remote location of the meter register and printer. Underwriters' Laboratory approved explosion-proof construction.
Smith-Erie meters + electric
key lock
Permits individual keys to operate individual counters and control entire system.

ADDAPTABILITY

WITH SMITH-ERIE YOU CAN ADD AN ACCESSORY TO SATISFY ANY PETROLEUM METERING NEED

From Smith-Erie — a complete line of meters for petroleum products *and* a complete line of metering accessories. Put them together and you have the flexibility necessary to meet any liquid measurement need. See your Smith-Erie meterman for complete details.

Through research ...*a better way*

A.O.Smith
CORPORATION
Smith-Erie Division

Factory: 1602 Wagner Ave., Erie, Pennsylvania. Offices: Atlanta 5, Ga.; Chicago 3, Ill.; Houston 2, Texas; Los Angeles 22, Calif.; New York 17, N.Y.; Newark, Calif., Tulsa, Okla. Canada: Toronto 12, Vancouver 1. A. O. Smith INTERNATIONAL S.A., Milwaukee 1, Wis., U.S.A.

REACTS WITH
THE STEEL...

inseparable new coating
cuts offshore costs

HUMBLE RUST-BAN® 190

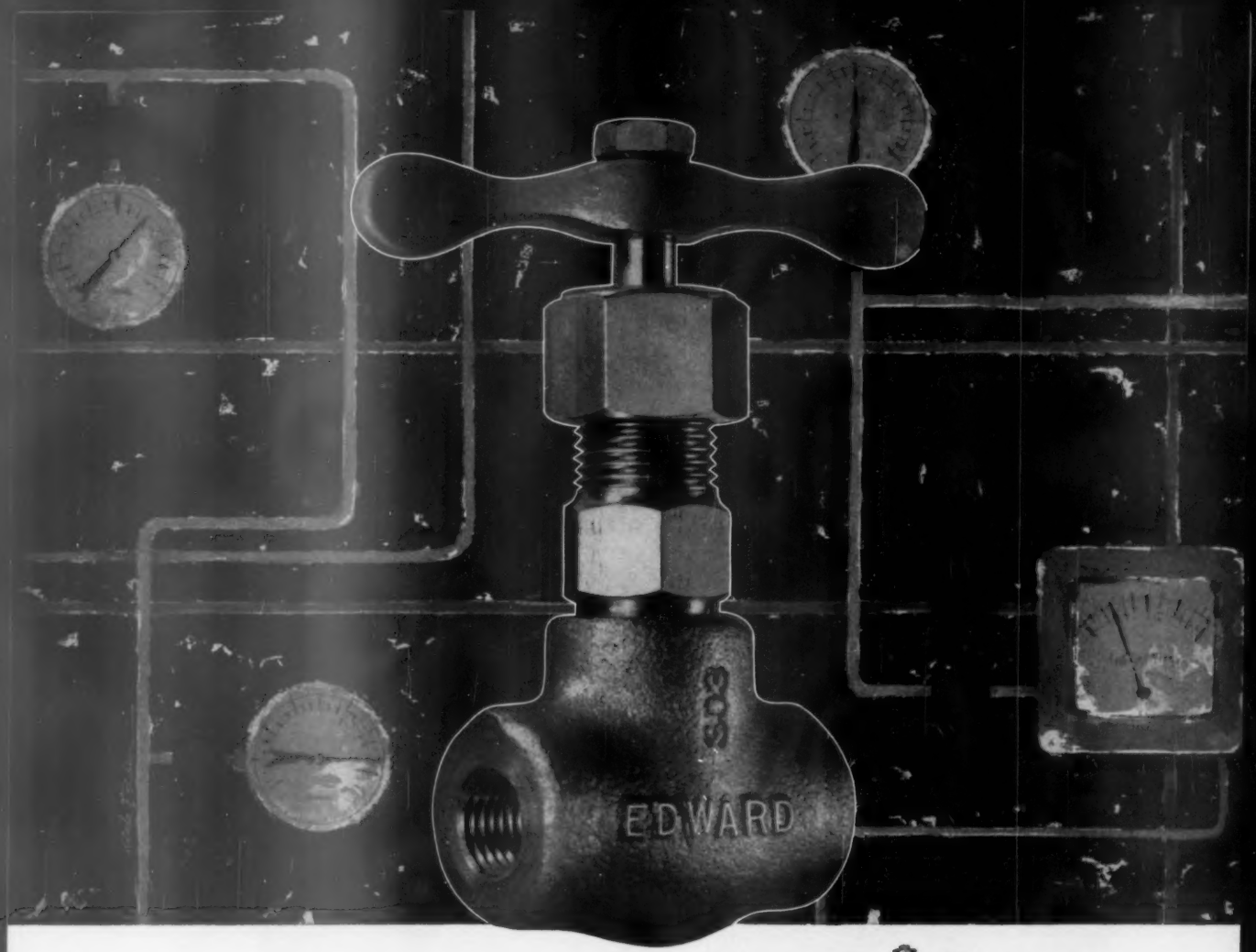
This remarkable new coating bonds so perfectly to steel that you cannot detect an interface! The reason? Humble RUST-BAN 190 reacts *chemically* with the steel. The resulting bond is inseparable... completely eliminating underfilm corrosion.

The hard, abrasion-resistant coating of 100% inorganic zinc silicate is also virtually impervious to scraping and impact. You get superior offshore protection for many years—at lower annual cost than is possible with any other type of coating. In immersed service, a Humble top coat is recommended.

RUST-BAN 190 contains no lead, is non-toxic, non-flammable and comes with curing solution RUST-BAN 195. For complete information, call your Humble salesman or contact Humble Oil & Refining Company, Houston, Texas.

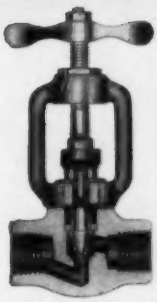
HUMBLE

America's Leading ENergy COmpany

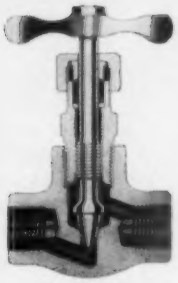


Edward Steel Gage and Instrument Valves provide dependable, finger-tip control

Edward gage and instrument valves will give you longer, more reliable service with less maintenance cost on pumps, separators, oil-field Christmas trees, and for meter, regulating, bypass, and dead-end lines. Edward gage valves are made of drop forged carbon steel or 18-8 stainless steel for sounder structure and greater strength than valve bodies machined from bar stock. Edward instrument valves have a carbon or 13% chromium stainless steel body. Carbon steel body has an integral cobalt-chromium-tungsten alloy steel seat that resists pitting and gives maximum resistance to corrosion and erosion. Choice of globe or angle body. For additional information, see your favorite distributor, or write to Edward Valves, Inc., 1212 West 145th Street, East Chicago, Indiana. Subsidiary of Rockwell Manufacturing Company.



Instrument Valve
Fig. 952 & 2952
6000 lb WOG



Gage Valve
Fig. 152 & 4152
4000 lb WOG

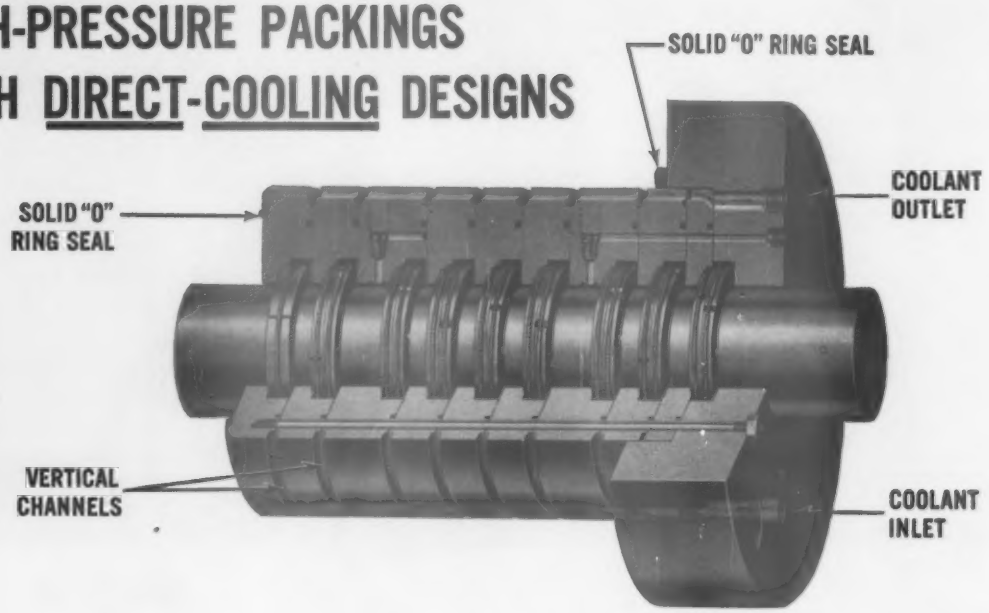
Contoured T-handle on both gage and instrument valves provides easy, finger-tip control. On gage valves, the bonnet and packing nut are EValized (exclusive Edward plating process) to minimize galling and corrosion. Instrument valves have EValized gland and gland bolt nuts, stainless steel gland bolts. Taper-threaded joint between bonnet and body of gage valves prevents bonnet from backing out of valve. Instrument valves are of bonnetless design. Semi-needle, integral stem-disk is made of EValloy 13% chromium or 18-8 alloy stainless steel, hardened for wear resistance.

EDWARD STEEL VALVES
another fine product by
ROCKWELL

ENGINEERING

NEWS YOU CAN USE ABOUT ENGINE AND COMPRESSOR PERFORMANCE

COOK TAKES HEAT OFF HIGH-PRESSURE PACKINGS WITH DIRECT-COOLING DESIGNS



Here is a packing that keeps cool *even at pressures up to 50,000 pounds per square inch.* It's one of Cook's new packings for high-pressure applications —typical of recent advancements in direct-cooling packing design.

Connections for the coolant are handled easily without arranging separate inlets or outlets through the stuffing box. Coolant enters a trunk line at the bottom of the packing, then completely encircles the case through a series of multiple vertical channels. Heat from the high-pressure packing is carried off by the coolant through the outlet trunk line at the top of the packing.

But direct cooling is not limited to new designs. Cook's creative design engineering provides almost unlimited possibilities for direct cooling, even on existing packings.

WRITE FOR MORE INFORMATION

If you want Cook engineers to review the special requirements of your specific high-pressure packing application, just write C. Lee Cook Division, Dover Corporation, 934 South Eighth St., Louisville 3, Kentucky. Or send for information about Cook's complete line of rings and packings.

COOK SEALS LIQUIDS AT EXTREME PRESSURES AND TEMPERATURES

C. Lee Cook has unique experience in the advancement of liquid-seal technology. Recently completed research and development contracts (one with a major airframe and missile manufacturer) have resulted in new concepts of seal design, materials compatibility, friction limitations and sealing efficiency. If yours is a special packing application, call in a Cook representative.

C. LEE COOK

DIVISION OF DOVER CORPORATION

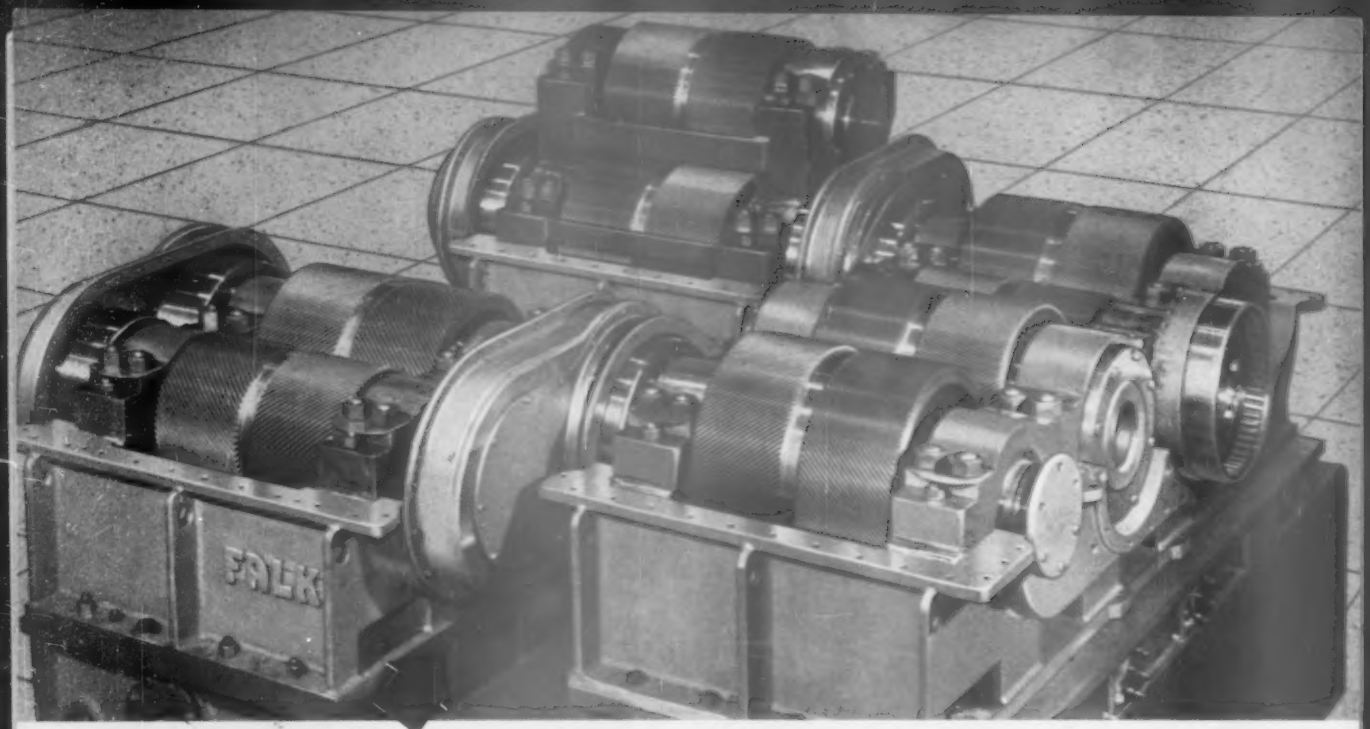
Rings and Packings Since 1888

FORCE YOUR DRILLING COSTS DOWN

WITH MILWHITE PRODUCTS AND MUD TECHNOLOGY

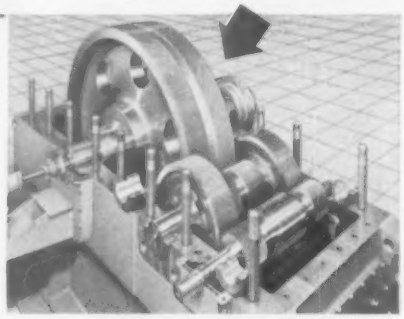
MILWHITE

MILWHITE MUD SERVICE COMPANY
HOUSTON, TEXAS



50,000 hp at 7,000 rpm

...or any other rating
FOR EXAMPLE:
6,900 hp at 7,000 rpm



When you talk high speed drives ...you're talking FALK

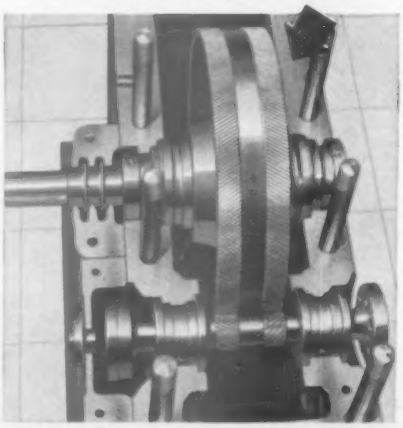
Whether you need drives for high speed or super high speed rotating equipment...for test rig or for daily on-the-line and round-the-clock duty... for wind tunnel, compressor, turbine, pump or other application, Falk has the experience and facilities to produce the single or double reduction drive you need. Falk has designed and built high speed drives for 50,000 hp or for 70,000 rpm...for 5,000 or for 50,000 ft/min pitch line velocity.

Any high speed drive you get from Falk will incorporate refinements which are made possible only by such broad experience. For details, see your Falk representative—or write us direct.

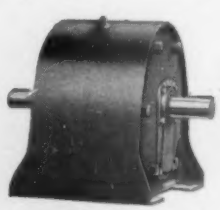
FALK is a registered trademark

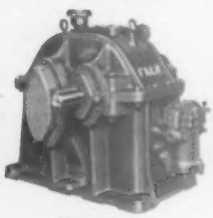
THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN
MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS
Representatives in Most Principal Cities

...or 100 hp at 50,000 rpm



FALK STANDARD HIGH SPEED DRIVES


Type S



Type Q

Type P

FALK
a good name in industry

HOKE Flow Sheet 5

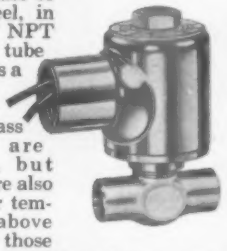
HOKE REPORTS ON FLUID CONTROL

WE'VE TOSSED A NEW BALL INTO AN OLD GAME

A VALVE NAMED "DESIRE"

With apologies to Tennessee Williams, we really have produced a Solenoid Valve line based on *your* desires. We surveyed all the solenoid valve users we could find to determine what *you* wanted. The result is Hoke's "User Designed" Series 90 and 95, two-way and three-way, direct-acting solenoid valve line.

Thanks to you, we have much to brag about. Here's what we have been saying about these new valves: lightest weight – smallest size – no-hum operation – lowest temperature rise – lowest power consumption – stainless steel plunger – silver AC shading coils – easiest installation – packless construction – 360° rotatable housing – operates in any position.



We make them of forged brass or stainless steel, in ⅛" and ¼" NPT size or JIC tube ends. There's a variety of AC and DC voltages. Class "A" coils are standard, but Class "H" are also available for temperatures above 212°F. For those with high insurance rates, we can supply explosion proof coil housings.

Now that we've bragged a bit, we must also apologize for our premature enthusiasm. We were so excited about this product that we stirred up a hornet's nest of interest before we were ready to deliver in quantity. Shipments were slow at the start, but now we can have any reasonable quantity of these "desirable" solenoid valves "on-stream" in your plant when you want them.

There's only one way to get conclusive performance proof – buy a valve. Ask for Bulletin SV-4-61.

A STEADY FLOW OF FACTS!

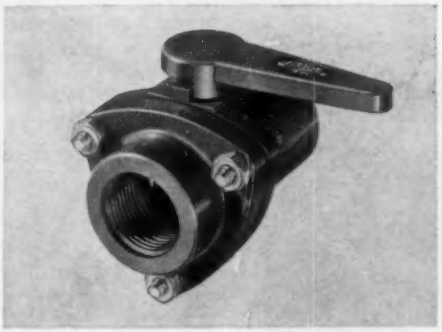
Further flow features, and interesting technical topics are carefully covered in Hoke's technical publication, the FLOW SHEET. It's free, but worth millions! To get the full benefit of our engineering and editorial efforts six times a year, mark your "X" in the proper box.

The technique of molding polyvinyl chloride into ball valve parts is old hat. Even the unplasticized compounds of type I PVC have been kicked around for a while (with minor successes). But until now, no one has booted the ball for a goal.

Perseverance, determination, and the pursuit of economic reward have prompted us to offer a line of ball valves molded of the toughest grade of type I, unplasticized PVC. There are no foreign agents to contribute to a corrosive demise, even in most caustic services. It even meets the proposed new ASTM specification and has a tensile strength of 8500 psi. Those who have had PVC piping problems will profit from the new molding process that gives these Hokes dimensional stability and very high impact strength. Sensitive systems, human and otherwise, are safe from contamination – they're absolutely non-toxic. We've set 140°F. as the operating temperature limit, but occasional excursions to 160°F. won't do any harm.

All standard models are supplied with a concentric hole drilled thru the ball. They can be heat welded, or solvent bonded right in the line. Piping hook-up is even simplified by their coupling-like assembly. Your assistant can fit each half of the valve to a pipe end, then reassemble the valve without having to turn the pipe. Pressures to 125 psi are duck soup for these valves.

A maintenance man's delight, they can be cleaned and have their seats changed without leaving the pipe. Their light weight makes them ideal for use on long, unsupported spans of pipe.



Size-wise, we're offering them in ½, ¾, 1, 1½, 2, and 3 inch sizes, all NPT female connections.

You will command the eternal admiration of your colleagues when you install these valves. Be the first to show your rightful status by ordering a shiny new Hoke polyvinyl chloride ball valve. If pride of ownership hasn't motivated you at this point, the mere fact that you are behind the scientific times should move you to find out more.

It isn't necessary to tell us why you want the additional information. Just check the coupon below. We'll forward the facts in a plain, brown envelope.

'61 PRODUCT PARADE

You'd be surprised at some of the screwball ways our valves have been used (to decided advantage, of course). Hoke distributors are armed to their maxillary third molars with this method madness and will redesign your systems (incorporating solenoid valves and PVC ball valves) at the drop of a postcard. Check the PRODUCT PARADE box.

Hoke's Performance Guarantee — *Every Valve Leak-Tested!*

HOKE, INCORPORATED
63 Piermont Road, Cresskill, N. J.

Send me complete information on the Hoke products checked below:

- ☐ PVC Ball Valves
- ☐ Solenoid Valves
- ☐ Product Parade
- ☐ Flow Sheet
- ☐ Complete Catalog GC960

NAME _____ TITLE _____

COMPANY _____

ADDRESS _____

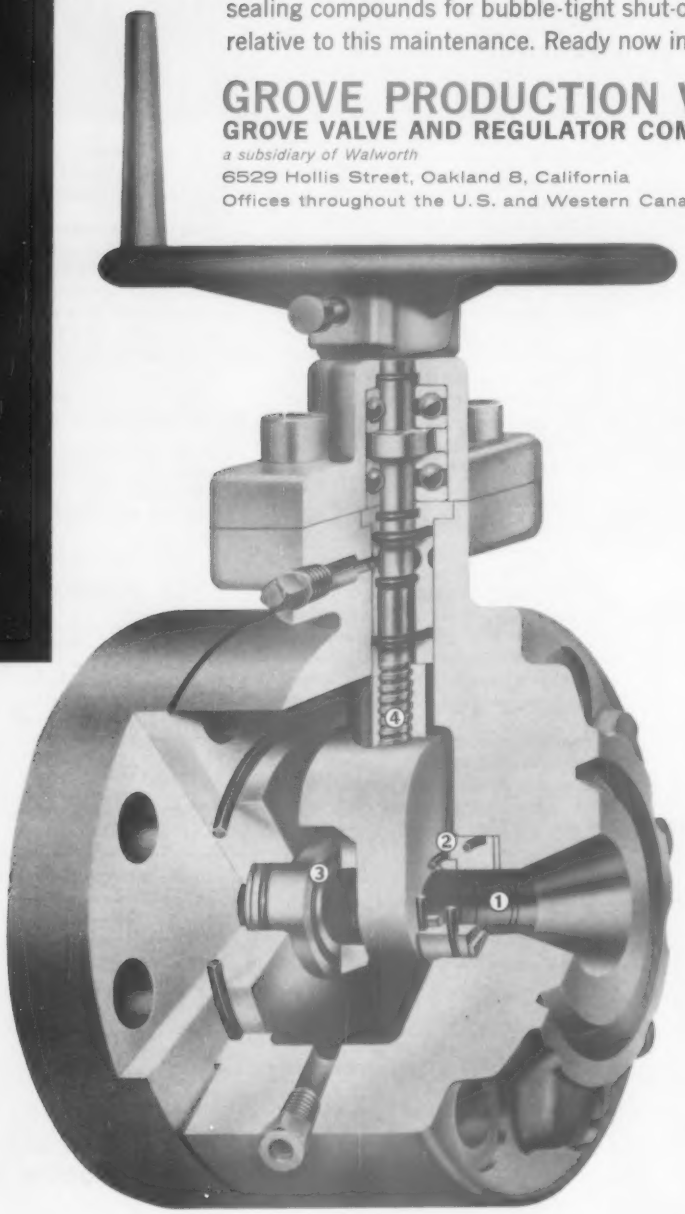
CITY _____ STATE _____

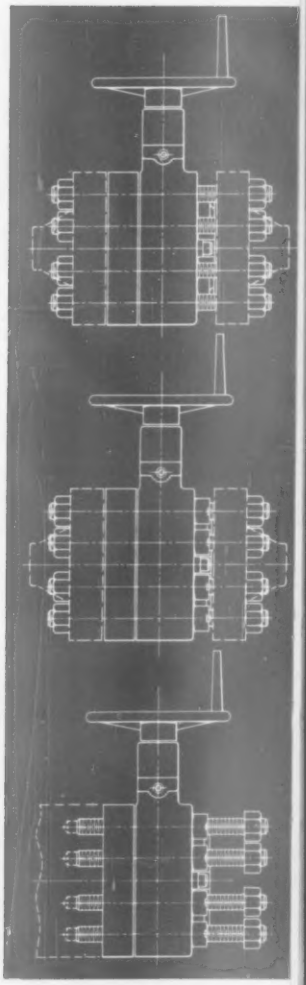
SEE OUR CATALOG IN SWEETS PRODUCT DESIGN FILE

GROVE G-6 REGULAR PORT VALVE
SIMPLE—COMPACT—VERSATILE

For Wing Valve, Tubing Head, Flow Line and Manifold services

Now the proven Grove Seal-"O"-Ring® design is ready in a compact regular port gate valve. Round opening (1) assures flow characteristics superior to plugs. Double-barrier seal gives positive metal-to-metal contact (2) backed up by protected o-rings (3) to keep gate clean, smooth for fast open/close. Non-rising stem (4) and "designed-in" compactness achieve overall height of only 14⅜". G-6 Regular Port gate valves, like all Grove valves, do not rely on sealing compounds for bubble-tight shut-off, thereby eliminating costs relative to this maintenance. Ready now in 2" API 3,000# and 5,000# wog.





GROVE PRODUCTION VALVES

GROVE VALVE AND REGULATOR COMPANY
a subsidiary of Walworth
6529 Hollis Street, Oakland 8, California
Offices throughout the U.S. and Western Canada

7181

VERSAMID®-Epoxy coatings are star performers for the petroleum industry

You can't find many coating applications more rugged than those of the petroleum industry. Highly corrosive products, scorching sun, extreme temperatures, harsh chemicals, salt water spray . . . this industry has them all. Coatings must be able to take it and the Versamid-epoxy combination comes through with flying colors.

On off-shore drilling rigs, Versamid-epoxy coatings have the "guts" to withstand salt water corrosion. In a test off the Florida coast, a commercial paint made with Versamid-epoxy resins was sound after two full years of torture. All oil based primers tested blistered and peeled after a year and a half of this treatment.

And, in the transportation of gas and petroleum products, internal pipeline coatings based on Versamid-epoxy resins set new highs in protection. They bond firmly to metal, have excellent resistance to abrasion and corrosion, and are highly flexible. Versamid-epoxy based coatings also require very little surface preparation, making them ideal for in-place pipeline coatings where moisture may be present.

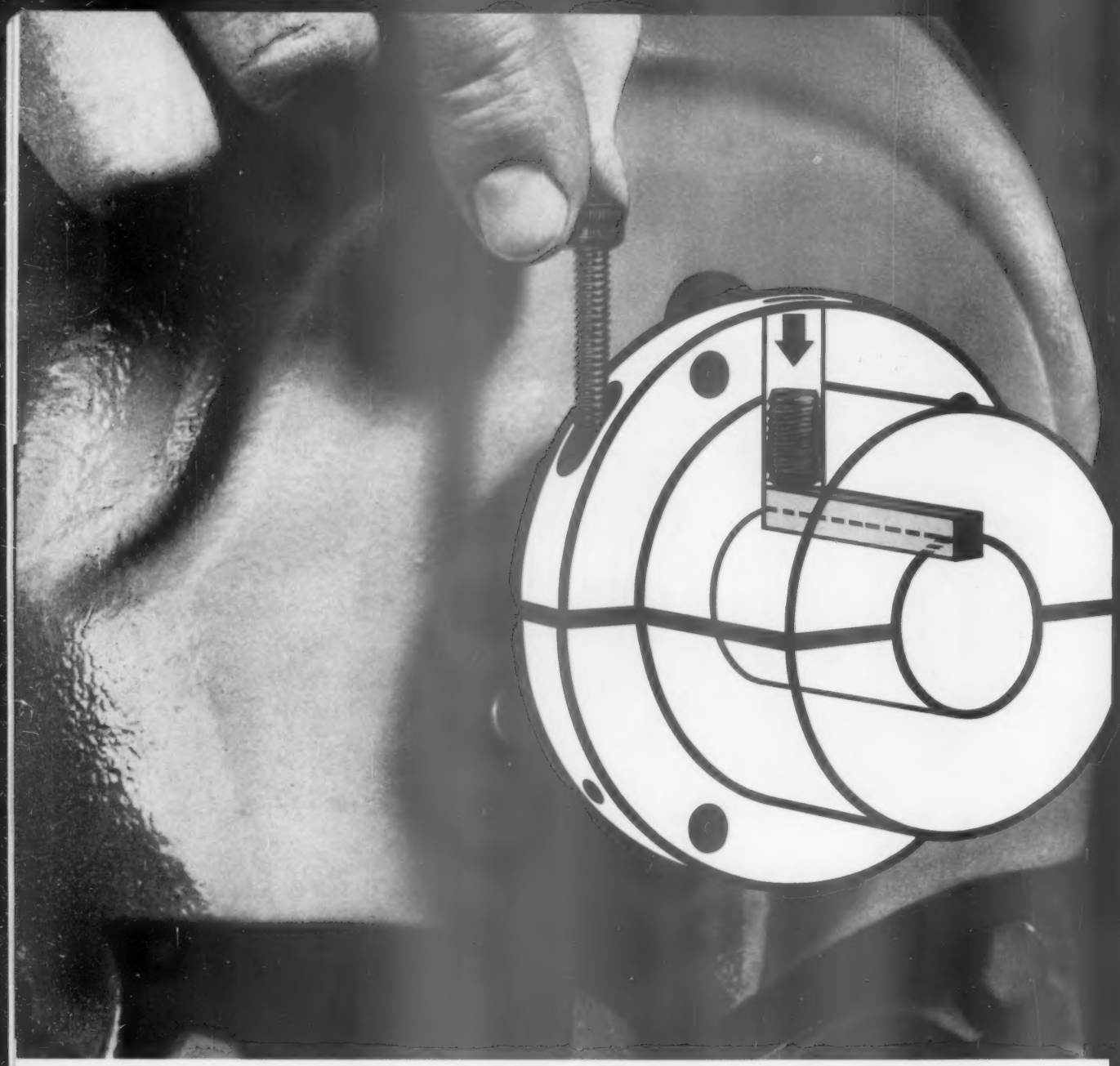
Versamid-epoxy coatings have helped answer the needs of a host of petroleum firms; maybe they can solve one of your "impossible" coating problems. Write today for the fact-filled Versamid booklet 11-D-3 on coating applications.

CREATIVE CHEMISTRY FROM GENERAL MILLS SERVES INDUSTRY WORLD WIDE

General Mills **CHEMICALS**

CHEMICAL DIVISION Kankakee, Illinois and Tlalnepantla, Mexico

Fatty Nitrogen Chemicals • Versamid® Polyamide Resins • GenEpoxy® Epoxy Resins • Deriphat® Amphoteric Surfactants • Steroids • Genamid® Epoxy Curing Agents



HALF SAFE IS

Have you ever heard of half an accident? Frankly, we don't think so—that's why Worthington gives you double protection by building *Two* Golden Screws into every Worthington hub.

One-half the protection lies in the Golden Screw at the right, above. See how it turns down to lock the key securely in place? This prevents potentially dangerous key drift.

How important is this Golden Screw? Decide its value in light of the maximum possible danger to equipment or personnel from a loose key. And then remember this—you pay no more for this Golden Screw in a Worthington sheave. You get extra value—for the same low price.

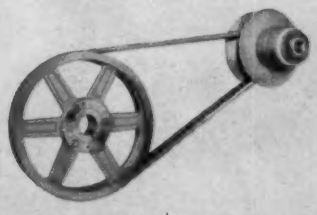
The Golden Clamp Screw on the left, above, allows you to locate and lock the hub securely on the shaft. Locking the hub allows you to tighten the set screw without distorting the hub. It is an exclusive Worthington feature. The two piece hub and rim design simplifies installation. You install one piece at a time. You can also make sheave changes without disturbing the hub or affecting the alignment.

Hubs with Two Golden Screws are supplied with each of the Worthington power transmission products shown at the right. Each product has its own advantages—and all have the extra, full safety feature of the Two Golden Screws at no extra cost.

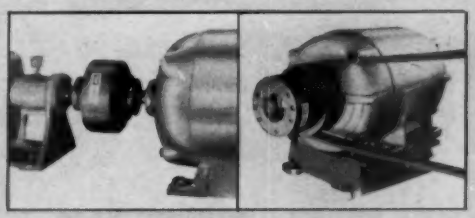
These products can work for your profit. Learn how they can be designed into your product or how they can add extra protection and performance into your plant. You can do this by asking for one or more of the "how-to-figure-it" design

MULTI-V OR MULTI-WEDGE? Multi-V drives have been an industry standard for years. Multi-Wedge drives, using a new, stronger belt design, cut costs sharply. They reduce the number of belts, use smaller, lighter sheaves and reduce center distances.

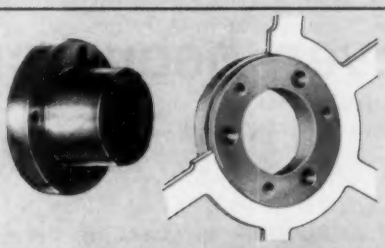
POSITIVE DRIVES. Worthington Positive Drives save weight and space and reduce bearing loads for machines ranging from typewriters to 600-hp giants. It combines the advantages of both chain and belt. There's no stretch, no metal-to-metal contact and no lubrication.



MOTOR PULLEYS AND COMPANION SHEAVES. The new Worthington variable speed Motor Pulley gives speed ratios up to 3:1 in ratings from ⅓ to 15 hp. It has the simplest, most dependable of all motor pulley designs. The companion sheaves feature the Two Golden Screw construction.



CENTRIFUGAL CLUTCHES. These fully automatic clutches protect against overloads and simplify starting problems. Two basic models. A clutch-coupling for direct motor drives and a drive clutch, tapered to receive standard Hy-Torque Multi-Wedge Sheaves, Positive Drive Pulleys or sprockets.



HUBS AND WELD-ON ADAPTERS. Make your product "quick detachable"—easier to mount, always tight on the shaft, easier to remove. Weld the QD Adapter to any shaft mounted part. Then use Worthington QD Hubs with Two Golden Screws. Or machine your part to use the QD Hubs.

NOT SAFE

manuals shown here. Your Worthington distributor stocks these products.

See the Yellow Pages to locate your Worthington Distributor.

WORTHINGTON

PRODUCTS THAT WORK FOR YOUR PROFIT

Each Worthington product shown here has the complete safety feature of the Two Golden Screw design. For more information about any of these products, please send this coupon.

WORTHINGTON CORPORATION
Section 79-41, Oil City, Pa.

Please send me your new catalogs on:

- ☐ Multi-V Drives
- ☐ Multi-Wedge Drives
- ☐ Positive Drives
- ☐ Variable Speed Pulleys & Companion Sheaves
- ☐ Centrifugal Clutches
- ☐ QD Adapters

Name_____

Company_____

Address_____

City_____ State_____

Even heavy crude can't kill this foam!

AFROX® 200 FOAMS SATURATED SALT WATER AND OIL

AFROX 200 is extending the advantages of air and gas drilling to a wider range of hole conditions because it foams where other foaming agents fail. AFROX 200 was formulated specifically to combat salt water invasion. Extensive field tests proved its ability to handle heavy intrusion and, in addition, showed its performance to be virtually unaffected by the presence of oil.

Foamed in 60% Oil In the application pictured above AFROX 200 was used after heavy crude and salt water had matted cuttings in the annulus. A slug of 6 gallons of AFROX 200 in 12 barrels of water was used to foam out fifty to sixty barrels of oil, water and cuttings. The fluid in the hole was estimated to be 60% oil.

Two AFROX Formulas AFROX 200 foams all water containing more than 5% salt and in the presence of oil. Oil-bearing fresh water is easily foamed by injecting AFROX 200 in a salt water solution.

AFROX 100 is designed to foam relatively fresh and oil-free water. It may be used where the salt content is less than 5%.

AFROX Foaming Agents are products of the Aquaness Department of Atlas Powder Company. They are distributed by leading mud companies and are available in all areas where air and gas drilling techniques are employed.

Write for new AFROX brochure, which gives complete information on the use of AFROX foaming agents.

ATLAS Aquaness CHEMICALS ATLAS POWDER COMPANY

Aquaness Department, Atlas Powder Company

P. O. Box 21072 • Houston 26, Texas

the OIL AND GAS JOURNAL

TULSA OFFICE
211 South Cheyenne Avenue
Box 1260
Phone LUther 4-4411

George H. Weber ..... Editor
Henry D. Ralph .. Chief Editorial Writer
Ted A. Armstrong ..... News Editor
Gerald L. Farrar ..... Engineering Editor
Frank J. Gardner .... Exploration Editor
Paul Reed ..... Pipeline Editor
W. L. Nelson ..... Technical Editor
Lynn M. Nichols .... Presentation Editor
John C. Casper ..... Economics Editor
W. B. Bleakley ..... Production Editor
W. A. Bachman ..... Marketing Editor
Neil Williams ..... Associate Editor
Peter B. Bike ..... Geophysical Editor
H. S. Pylant, Petrochem. & Gas-Process. Editor
John P. O'Donnell .. Asst. Pipeline Editor
Jo Jeanne Speaker ..... Staff Artist

R. B. Tuttle ..... Equipment Editor
C. Dudley Johnston ..... Art Director
Robert B. Bizal ..... Editorial Research
John C. McCaslin ..... District Editor
Merle F. Blakely ..... District Editor
Sara Duncan ..... District Editor
Kenneth W. Brooks ..... District Editor
Norman K. Baxter ..... District Editor
Edward A. Martin ..... District Editor
Max L. Batchelder .... Asst. Pres. Editor
Helen Brown ..... Editorial Assistant
Alice Burt ..... Editorial Assistant
Ailleen Cantrell ..... Editorial Assistant
Margaret Higgs ..... Editorial Assistant
Marilyn Chance ..... Editorial Assistant

NEW YORK OFFICE
500 Fifth Avenue
Phone LOngacre 4-1910
D. H. Stormont ..... Refining Editor
Paul Swain ..... International Editor
Gene T. Kinney ..... East Coast Editor
Ray G. Gibson ..... District Editor

DALLAS OFFICE
1238 Mercantile Bank Building
Phone RIverside 8-5701
Robert J. Enright ..... District Editor

LOS ANGELES OFFICE
650 South Grand Avenue
Phone MAdison 2-0722
Carl J. Lawrence .... West Coast Editor

HOUSTON OFFICE
802 American Investors Building
Phone CApitol 4-7726
Ed McGhee ..... Drilling Editor
Howard M. Wilson ..... District Editor
H. C. Bozeman Gulf Coast Refining Editor

WASHINGTON OFFICE
621 Albee Building
Phone DIstrict 7-1710
Clyde La Motte ..... Washington Editor

BUSINESS STAFF
P. C. Lavinger ..... President
S. H. Rourke .. Executive Vice President
Mitchell Tucker . Vice Pres. and Adv. Mgr.
Kenneth B. Barnes .... Vice Pres., Eastern Hemisphere Operations
Hanson B. Pigman . Vice Pres., Circulation
L. John Ford ..... Mgr. Industry Census
J. Parker Holland ... Ass't. to V.P., Adv.
Paul McBride ..... Production Manager

ADVERTISING STAFF

TULSA OFFICE
211 South Cheyenne Avenue
Phone LUther 4-4411
John D. Reilly .. Mid-Continent Manager
Roy E. Finley ..... District Manager
Philip C. Lavinger, Jr. ... Representative
William H. Dickey .. Classified Adv. Mgr.

NEW YORK OFFICE
500 Fifth Avenue
Phone LOngacre 4-1910
E. S. Klappenbach .... Eastern Manager
Harry B. Bullen ..... District Manager

PHILADELPHIA OFFICE
1509 Land Title Building
Broad and Chestnut Streets
Phone LOcust 3-0118
John W. Meany, Jr. .... District Manager

PITTSBURGH OFFICE
Law & Finance Building, 429 Fourth Avenue
Room 1050
Phone GRant 1-5847
Ernest S. Holzworth .... District Manager

HOUSTON OFFICE
802 American Investors Building
Phone CApitol 4-7726
John M. Spears .... Gulf Coast Manager

LOS ANGELES OFFICE
650 South Grand Avenue
Phone MAdison 2-0722
George O. Ruppert .... District Manager

CHICAGO OFFICE
105 West Madison Street
Phone CEntral 6-2537
David T. Kenney ..... District Manager
Karel Wegkamp ..... District Manager

DETROIT OFFICE
204 Washington Square Building
Royal Oak, Mich.
Phone LIncoln 7-9455
John D. Yoder ..... District Manager

DALLAS OFFICE
1238 Mercantile Building
Phone RIverside 8-5701
Pren G. Hollingsworth .. District Manager

ENGLAND
67/68 Jermyn Street, St. James's,
London S.W. 1. Phone TRAfalgar 6318
Max Holsinger .... Director International Sales Operations
A. T. Chapman-Purchas .. Group Manager
11 Tewit Well Road, Harrogate, Yorkshire
Philip King ..... Northern Manager

WEST GERMANY
Düsseldorf Huttenstrasse 17, am
Phone 10493
Ing. Georg Wilhelm Rohde—Group Mgr.

FRANCE
6, rue Franklin Roosevelt, Paris 8e
c/o Soc. D'Etudes Petrolieres, 3 Etage
Phone, BALzac 66-70

Subscription rates to the petroleum industry United States and foreign, 1 year, $6.00; 2 years, $9.00; 3 years, $12.00. Single copies $1.00. Back copies when over a year old, $2.00.

Member
Audit Bureau of Circulations
Associated Business Publications

They Say—

Bravos and boos

Dear Sir:

Thank you, Mr. Ralph, along with Mr. Carroll. The Journally Speaking article "Thank You, Mr. Carroll," (OGJ, May 1, p. 53) is the best that I have read for many, many years. My sincere compliments and congratulations on a journalistic masterpiece.

Angus A. Davidson, Counsel
Sinclair Oil & Gas Co.
Tulsa

Dear Sir:

Your "Thank You, Mr. Carroll" (May 1, p. 53) is terrific.

Ken B. Harper, Director of Publications
Transcontinental Gas Pipe Line Corp.
Houston

Dear Sir:

Thanks very much for your kind column of April 17 relating to our project (Journally Speaking, "Full Many a Gem," p. 59). The wind of the oil industry is indeed shifting and you have scented the change.

There are indeed many ways of improving drilling operations (the only aspect of the oil industry in which I claim any competence) but the changes probably will have to come from persons who are uninhibited by any great knowledge of existing methods.

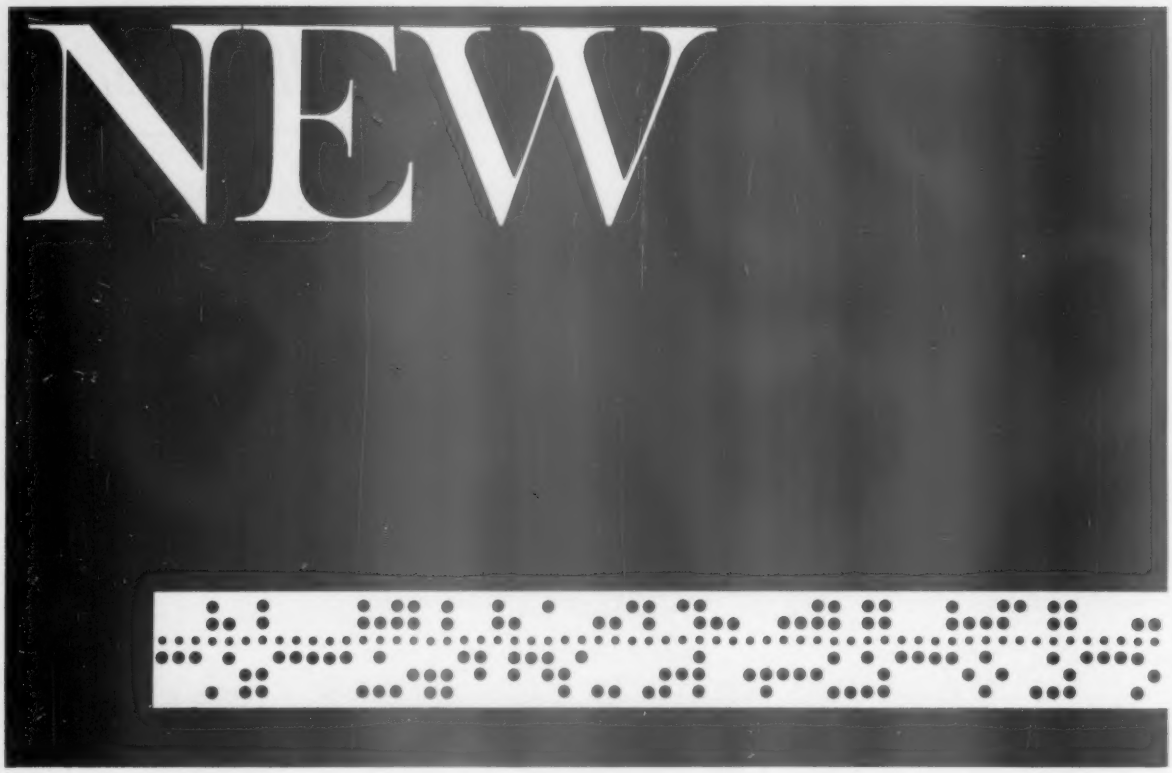
The fact that present drilling methods "work" is hardly an excuse for nineteenth century mechanical engineering.

Willard Bascom, Director
National Academy of Sciences
National Research Council
Washington

Dear Sir:

This letter is written to call your attention to an incorrect and misleading statement in your April 24 Journally Speaking, page 57.

The statement to which I refer follows: "What the AAPG figures failed to show was the number of technically successful wildcats that



Dowell provides electronic computer calculations to help operators select best frac treatments

Dowell's new electronic computing service is now providing rapid calculations – based on the Frac Guide* – to help operators select fracturing treatments best suited to their needs and available funds. This new service by Dowell costs you nothing extra, yet it offers operators new opportunities for greater profits from fracturing.

The computer provides calculations comparing the effects of different fracturing fluids, injection rates and propping agents for a given set of well conditions.

The computer output shows predicted production increase, treatment cost and payout for each treatment analyzed. These data can be plotted on graphs to give the operator a visual comparison of the treatments being considered.

The big advantage of Dowell's computing service lies in speed of calculations. Until now, it took an engineer something like a full day to calculate a single treatment with only a few variables. The computer requires less than ten minutes. This, coupled with Dowell's nation-wide teletype system, makes it possible to provide customers with many calculations quickly – usually in only a few hours.

Accuracy is another advantage. The computer minimizes the possibility of error in calculations and frees engineers to double check input data for accuracy and completeness. The result is more accurate, more reliable calculations than ever before.

Again, Dowell is helping operators improve fracturing results. Again, there is no extra cost. Ask for full information. Dowell services and products are offered in North and South America, Europe and North Africa. Dowell, Tulsa 1, Oklahoma.

*DOWELL SERVICE MARK

SERVICES FOR THE OIL & GAS INDUSTRY

DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

were abandoned after a short production test, or were marginal stinkers that never paid off."

Following is a quotation from the June 1959, issue of the AAPG Bulletin, page 1133: "The ratio of profitable fields discovered each year to total new-field wildcat wells drilled ranges from 1 to 36 in 1944 to 1 to 55 in 1952. In other words, in 1944 there were 32 dry holes drilled for each profitable oil discovery and in 1952 there were 48 wildcat dry holes drilled for each profitable oil discovery. During 1952, 98.17% of all the wildcat wells drilled resulted as failures in that they were abandoned as dry holes or they discovered reserves too small, on the average, to be profitable."

Similar evaluations have been included in previous reports by the AAPG.

In fairness to the AAPG and to the authors of the exploration articles, you should acknowledge the misleading aspect of your statements.

Claude W. Shenkel, Jr.
Professor of Geology
Kansas State University

Dear Sir:

Another brickbat to Mr. Ralph for his journalistic slap at the geological profession (April 24, p. 57).

Robert B. Ross
Tenneco Oil Co.
Jackson, Miss.

The brickbats were really aimed at the industry's critics who don't know enough about the oil and gas business to interpret wildcat statictics properly.—Ed.

Credit due Aero Service

Dear Sir:

In your March 6 issue you used two photographs showing hydrocarbon plant locations in the U. S. This was in connection with your report of R. K. Treichler's paper on chlorinated hydrocarbons presented at the recent meeting of American Institute of Chemical Engineers in New Orleans (OGJ, Mar. 6, "Versatile Chlorinated Hydrocarbons," by R. K. Treichler, Dow Chemical Co., p. 112).

The relief maps used as background for the plant locations were made and copyrighted by the Aero Service Corp. of Philadelphia. We

Hartzell REPORTS ON
Air Fin Cooler Fans in Germany

In Germany, the U.S. and around the globe, Hartzell cooling tower and heat exchanger fans are recognized for continuous, trouble-free performance.

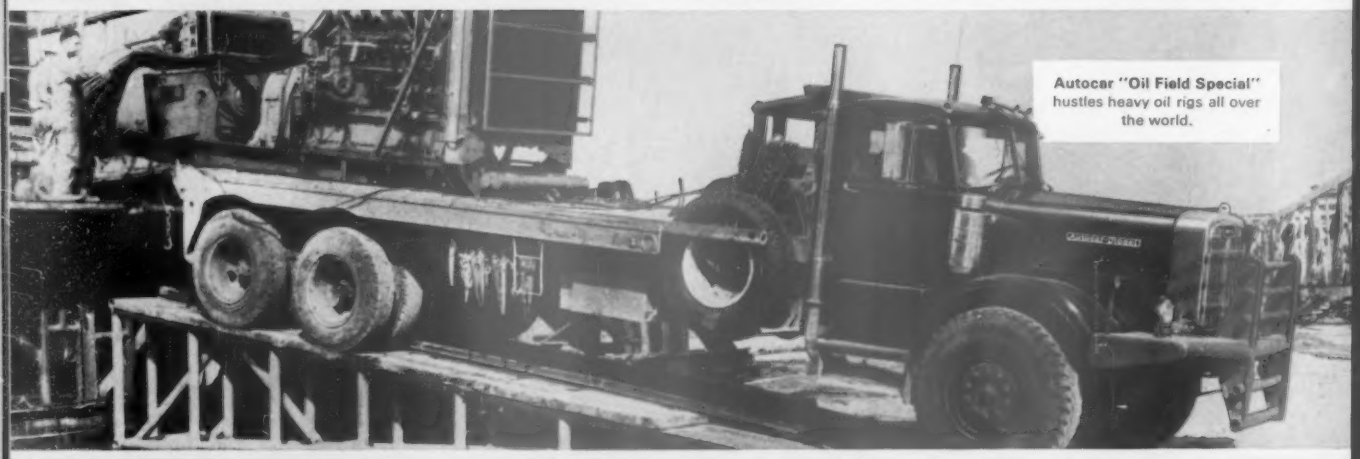
At Esso's Refinery in Cologne, Germany, Hartzell six-bladed fan assemblies have been operating since November, 1958, delivering top-notch cooling performance.

Important reasons for this performance bonus are • AUTOMATIC AND INSTANTANEOUS CONTROLLABLE pitch settings that hold outlet temperature fluctuation to ±1½° F by increasing or decreasing blade pitch as cooling requirements change. • Up to 50% POWER SAVING since the pitch of the fan blades is rarely at maximum. • COMPLETE SIZE RANGE.

Whatever your requirement, look to Hartzell for your cooling tower and heater exchanger fans that cover every application. Write for bulletin A-111B.

Hartzell PROPELLER FAN COMPANY
PIQUA, OHIO
Engineering offices in principal cities
Div. of Castle Hills Corp.
HARTZELL

Autocar "Loggers' Special" carries 8000 board feet of pine over rugged mountain roads.



Autocar "Oil Field Special" hustles heavy oil rigs all over the world.

Autocar "Michigan Special" hauls 47-ton payload, making the most of Michigan laws

Custom Builders to the Trucking World

Wherever hauling duties are rugged and steady . . . wherever maximum performance is crucial, back comes the message, "We need Autocars . . . nothing less."

So you find Autocar hauling oil equipment over the shifting sands of Libya, carrying maximum legal loads under the many varying state laws, doing the ruggedest off-the-highway/over-the-highway work.

Every Autocar is custom-engineered from "rubber to roof" for its specific job. Components are perfectly matched throughout its design and construction—always with an eye to quality. Frame rails, for example, are made of the finest steel . . . custom-drilled to avoid unnecessary holes and to assure perfect alignment of components.

For you, Autocar produces just the truck, at a reasonable cost, that will earn the most on your investment. Buy less if you can afford it—but where every dollar counts, buy the "World's Finest."

Autocar
"World's Finest"

Division of
THE WHITE MOTOR COMPANY
Exton, Pa.

should have credited Aero Service Corp. in the paper for the maps, and would appreciate your doing so in your letters column.

W. W. Boddie
Director of Public Relations
Dow Chemical Co.
Freeport, Tex.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

MAY

21-24 American Petroleum Institute, Division of Transportation, midyear highway conference, Bellevue Stratford Hotel, Philadelphia.

22-25 Design Engineering Show, Detroit, Mich.

24-25 Western Petroleum Refiners Association, computer conference, Ben Franklin Hotel, Philadelphia.

25 Pennsylvania Grade Crude Oil Association, Bradford District Pennsylvania Oil Producers Association, joint annual meeting, Pennhills Club, Bradford, Pa.

25-26 American Institute of Mining, Metallurgical, and Petroleum Engineers, annual Rocky Mountain petroleum sections, joint meeting, Farmington, N. M.

25-26 American Gas Association, gas transmission conference, Brown Palace and Cosmopolitan hotels, Denver.

28-June 2 Special Libraries Association, petroleum section meeting, San Francisco.

JUNE

1 American Chemical Society, Southwest Louisiana section, and American Institute of Chemical Engineers, Southwest Louisiana section, sixth joint technical conference, McNeese State College, Lake Charles, La.

1-2 Kentucky Oil and Gas Association, annual meeting, Phoenix Hotel, Lexington.

1-3 Interstate Oil Compact Commission midyear meeting, Shamrock-Hilton Hotel, Houston.

5-6 Petroleum Electric Power Association, meeting, Mayo Hotel, Tulsa.

6-8 Instrument Society of America, summer instrument-automation conference and exhibit, Royal York Hotel and Queen Elizabeth Hall, Toronto.

6-8 Sixth annual Appalachian underground corrosion short course, West Virginia University, School of Mines, Morgantown, W. Va.

9-17 European Congress of Chemical Engineering and Achema Congress, thirteenth exhibition and congress of chemical engineering, Frankfurt am Main, Germany.

11-15 American Society of Mechanical Engineers, summer annual meeting, Statler Hilton Hotel, Los Angeles.

11-16 American Petroleum Institute, Division of Production, midyear committee conference, St. Francis Hotel, San Francisco.

12 Instrument Society of America and Air Pollution Control Association, air pollution instrumentation symposium, Hotel Commodore, New York City.

12-14 American Petroleum Institute, Division of Transportation, annual tanker conference, Oyster Harbors, Cape Cod, Mass.

12-16 Gordon Research Conferences, petroleum, Colby Junior College, New London, N. H.

13-16 Instrument Society of America, biennial international gas chromatography symposium, Kellogg Center, Michigan State University, East Lansing, Mich.

19-23 Harvard University, School of Public Health, air cleaning institute, Cambridge, Mass.

19-23 Gordon Research Conferences, catalysis, Colby Junior College, New London, N. H.

20-22 National Association of Corrosion Engineers, Greater Boston section, corrosion short course, Wentworth Institute, Boston.

20-24 Canadian Gas Association, annual meeting, Banff Springs, Alta.

22-24 American Association of Petroleum Landmen, annual meeting, Shamrock Hilton Hotel, Houston.

25-30 American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City,, N. J.

26-27 Michigan Gas Association, annual meeting, Grand Hotel, Mackinac Island, Mich.

26-July 7 Massachusetts Institute of Technology, summer program on dynamics and control of chemical engineering processes, Cambridge, Mass.

28-30 International Gas Conference, Stockholm, Sweden.

28-30 Instrument Society of America, joint automatic control conference, Boulder, Colo.

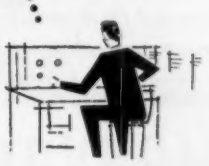
JULY

4-7 National Society of Professional En-

streamlined production

CUTS COSTS . . . IMPROVES PRODUCT AT ENARDO

Enardo, the company who pioneered a whole new concept in lease storage equipment, has again taken a major stride forward by instituting a totally new program of engineering and management services plus a complete revitalization of production facilities. Because of these streamlined methods, Enardo Thief Hatches, Vent Valves, Burner Assemblies and other items in a complete line of oil field accessories have been lowered in price, yet maintain their unsurpassed quality. Another innovation at Enardo is the improved inventory control system. Upon receipt of an order, the item is located, packed and on its way to the customer within minutes! All this adds up to greater savings, better products and speedier deliveries when you specify Enardo equipment for your lease. Call, write or wire Enardo Manufacturing Co. for further information.



ENARDO manufacturing co.
BOX 1647 • TULSA, OKLAHOMA

DEMULSIFIERS

★ lower temperature

★ cleaner oil

★ more oil

★ BETTER PRICE

AT SUPPLY STORES

BrakeSol INC.
REG. U.S. PAT. OFF.

P. O. BOX 9506
OKLAHOMA CITY, OKLAHOMA

gineers, twenty-seventh annual meeting, Olympic Hotel, Seattle.

6-8 International Oil Scouts Association, annual meeting, Roosevelt Hotel, New Orleans.

10-21 University of Michigan, summer course on underground storage of natural gas, Ann Arbor, Mich.

26-28 American Petroleum Institute, Division of Production, eastern district meeting, The Greenbrier, White Sulphur Springs, W. Va.

AUGUST

2-4 Wyoming Geological Association, sixteenth annual field conference, Green River, Wind River, and Powder River basins.

28-30 Appalachian Gas Measurement Short Course, West Virginia University, Morgantown, W. Va.

28-Sept. 1 American Society of Mechanical Engineers, international heat transfer conference, Boulder, Colo.

SEPTEMBER

5-8 American Chemical Society, Chicago section, eleventh national chemical exposition, International Amphitheatre, Chicago.

7-9 Magic Plains Oil Exposition, Borger, Tex.

11-15 Instrument Society of America, fall instrument - automation conference and exhibit and sixteenth annual meeting, Biltmore Hotel and Memorial Sports Arena, Los Angeles.

12-13 American Gas Association, Southern Gas Association, annual accident prevention conference, Statler Hilton Hotel, Dallas.

13-15 Pacific Coast Gas Association, convention and annual meeting, Coronado Hotel, Coronado, Calif.

13-15 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division, annual meeting, Rossevelt Hotel, New Orleans.

13-15 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

14 Natural Gasoline Association of America, Rocky Mountain regional meeting, Northern Hotel, Billings, Mont.

15-16 Kansas Geological Society, annual field conference, Mark Twain Hotel, Hannibal, Mo.

17-20 American Institute of Electrical Engineers, annual electrical conference of the petroleum industry, Jung Hotel, New Orleans.

18-19 Independent Natural Gas Association of America, annual meeting, Shamrock Hilton Hotel, Houston.

20-21 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-27 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Muehlebach Hotel, Kansas City.

25-27 Texas Mid-Continent Oil and Gas Association, annual meeting, Texas Hotel, Fort Worth.

OCTOBER

1-4 American Gas Association, annual convention, Dallas.

4-6 American Association of Oilwell Drilling Contractors, annual meeting, Rice Hotel, Houston.

4-6 American Society of Mechanical Engineers, process-industries conference, Shamrock-Hilton Hotel, Houston.

HERCULES UPSET PUMPING AND FLOWING TEES
Produced from malleable iron with 55,000 psi tensile strength and with an operational rating of 3,000 psi test; 1,500 psi working pressure.

HERCULES CROSS TEES
Made from malleable iron with 55,000 psi tensile strength. These Tees have an operational rating of 4,000 psi test and 2,000 psi working pressure.

HERCULES SPECIAL CROSS TEES
Designed especially to allow adaptation of wider range of thread connections to meet each customer's requirements.

HERCULES TEES

Hercules produces a versatile line of Tees in a wide range of API pipe sizes and threads, in stock for immediate shipment. For general service, Hercules Tees are constructed from malleable iron. For service on wells with corrosion or electrolytic conditions, Hercules Tees are available from other test-proven metals.

HERCULES (DS) DUAL STRING PUMPING TEES
Hercules DS steel pumping Tees were designed primarily for use on dual string pumping wells having minimum center-to-center distances of 3 3/64". This Tee may be screwed onto one string of tubing without contacting the other string. Constructed of pressure cast steel and hydrostatically tested to 5,000 psi.

Write for data on pipe sizes and threads of all Hercules Tees

HERCULES TOOL COMPANY
Manufacturers of Oil Field Equipment
GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA
Export Representative: Oil Field Equipment Co., Inc., 90 West Street, New York, N. Y.

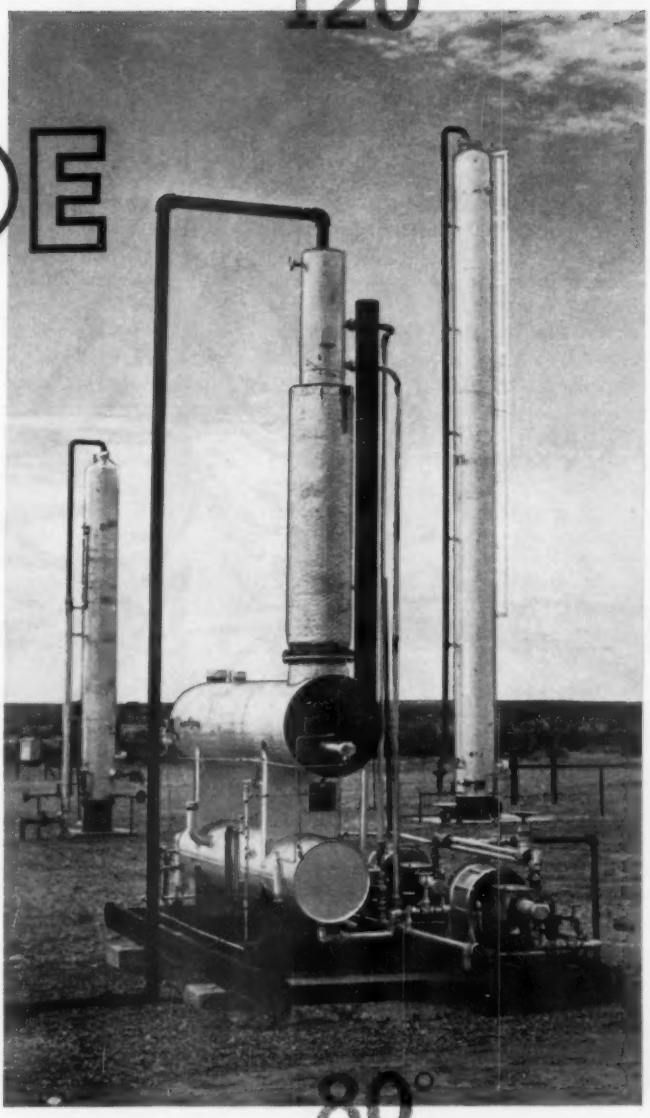
It's what's iNSiDE that counts

The "DEW DROP"... BS&B's High Dewpoint Depression Dehydrator will give you a guaranteed dew point depression up to 140°... if you want it.

The plain fact is, there just are no limitations to operational dewpoint control with the "DEW DROP."

- DEW DROP makes it possible to economically dehydrate natural gas streams at higher inlet temperatures without using expensive inlet cooling.
- DEW DROP makes it possible to dehydrate natural gas to much lower dewpoints without utilizing expensive solid desiccant dehydrators.
- DEW DROP is the result of extensive product research and development at BS&B's own R&D facilities and all guarantees are backed by both laboratory and field operational data.
- DEW DROP is the answer to your high dewpoint depression requirements—in fact, BS&B has a dehydrator for any gas dehydration problem.

Your local BS&B sales representative will be glad to assist you in recommending the proper dehydrator for your gas streams. Write BS&B, Dept. 1-A5A Box 1714, Oklahoma City, Okla.



This DEW DROP is part of North Central Oil Corporation's gas sweetening plant located on the Hokit Lease, Pecos County, Texas.

BS&B

BLACK, SIVALLS & BRYSON

OKLAHOMA CITY • KANSAS CITY • TULSA • EDMONTON • THE HAGUE

Number 6 of a Series
TELL THIS PETROLEUM INDUSTRY FACT TO YOUR NEIGHBOR

1776 to SAC

From the protective goose grease on the Minute Man's musket to modern fuels for jet interceptor planes of the Strategic Air Command (SAC), America's defense and industrial might have depended on oil. No other purely civilian industry has been as defense-conscious as the essential petroleum industry.

In every branch of the oil and gas industry: exploration, production, refining, transportation, marketing . . . and in the supply and service companies . . . progress is made without subsidy. Strong domestic reserves, efficient processing plants and improved distribution methods are factors responsible for the industry's progress. In defense and in business, wherever we may venture, the basic concept of free enterprise must be maintained if we are to remain strong.

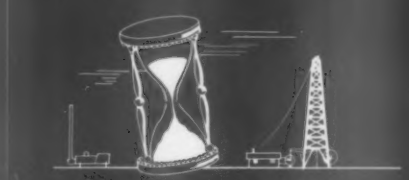
©COPYRIGHT 1961 BAROID DIVISION NATIONAL LEAD COMPANY

BAROID

BAROID DIVISION NATIONAL LEAD COMPANY
MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

BAROID—*Still Pioneering Drilling Mud Research • Engineering • Marketing*

Reproduction proofs of this message are available with or without the Baroid Signature . . . Write Advertising Manager, Baroid Division.
6105



JOURNALLY SPEAKING

50 years ago

May 25, 1911

The busiest place on the oil map now is around Carlyle, 50 miles east of St. Louis, in Clinton County, Illinois, where more than 30 drilling rigs are running within a radius of the five producing wells completed so far. Operators from eastern fields, Oklahoma, and other southwestern areas are pouring in to get in on the play.

A combine of English and Canadian capitalists with St. Louis and New York interests has acquired the Busch-Everett gas rights in the Caddo fields of northwestern Louisiana, and the Adolphus Busch franchise to furnish natural gas to New Orleans. A 318-mile pipeline to New Orleans with a possible extension to Gulfport, Miss., is to be laid from the fields.

25 years ago

May 21, 1936

Gulf Refining Co. joins the growing list of big companies getting into the flush, rapidly expanding Rodessa field in northwestern Louisiana. Reported $15,000,000 deal gives Gulf one-half interest in properties of Standard Oil Co. of Louisiana. Only Stanolind Oil & Gas Co., Atlantic Refining Co., and Tide Water Oil Co. are left of big units without representation in the area.

Daily average crude-oil production for the past week passes the 3,000,000-bbl. mark for the first time. New peak output of 3,005,440 bbl. daily exceeds country's previous all-time record of 2,975,435 bbl. set in August 1929.

Survey reveals oil industry will spend near one billion dollars for equipment and supplies during 1936.

10 years ago

May 24, 1961

New type of oil-well surveying tool tried out in West Texas. Ultrasensitive device locates points of casing failure, picks cement tops, and reports location of gas or liquid flows.

World's largest vacuum flasher goes on stream at Standard Oil Co. of Californin's, Richmond, Calif., refinery. New unit has 55,000-bbl. capacity.

World oil production for month reaches new all-time high of 11,542,000 bbl. daily. United States and Venezuela are major contributors.

Potential gas reserves of Alberta Province, in western Canada, are estimated at 12.7 trillion cubic feet.

Plowed-Under Pigs

SEEMS like every subject this department mentions lately stirs up a controversy.

Here we sit trying to dream up a few lighthearted comments on developments around the fringes of the oil industry which aren't of sufficient significance to warrant serious treatment in other parts of the Big Yellow Book, and first thing we know we've opened a can of worms.

For instance, in the April 10 issue we casually observed that there seems to be a trend for younger men to be shoved into top positions in many oil companies.

So now we get some pretty caustic comments from a couple of oldtimers. To preserve their anonymity, we didn't turn the letters over to our "They Say" department. But their point of view needs expressing, so we'll carry some excerpts here:

"I will go along with you and buy some of the statements you made, but in my modest opinion your subject is highly controversial and debatable. As for myself, I am in my middle fifties, having spent more than 34 years in our industry.

"I have put my whole life and soul into the industry, and given it much more than it has given me. It is extremely galling to have been shoved around and figuratively knifed in the back by some of these so-called wonder boys in two different corporations . . .

"It is my observation that youth's judgment is not seasoned; it is heartless and cold and selfish. Youth believes in freezing out initiative, and does not weigh all the facts but jumps at some wild brainstorm in making decisions . . .

"The youth movement has been going on for 3 years. Economic conditions have been going from bad to worse during these 3 years. Can you blame the burr-head youth movement for this intolerable condition?

"Many of the major companies and large independents boast in glowing terms of their increased earnings and record profits for the past year or two. No mention is ever made of the hundreds and thousands of good, experienced oil men who were fired outright or retired to make way for a smart-aleck burr-head . . .

"Youth has no loyalty, no consideration for his fellow man, and has put the industry in an unfavorable light in the public eye . . . I could go on and on to the point of vituperation . . ."

Thank goodness he stopped before reaching the point of vituperation.

The other old-timer was more philosophical about it. He wrote:

"I have been showered with the dust of some of these fine young fellows on their way up, and my hat is off to them and to the oil industry which is availing itself of their services.

"This game of musical chairs is a kids' game and it is not a recent invention. Centuries ago King Rehoboam 'forsook the counsel of the old men, which they had given him, and consulted with the young men that were grown up with him, and which stood before him' (I Kings 12:8) . . .

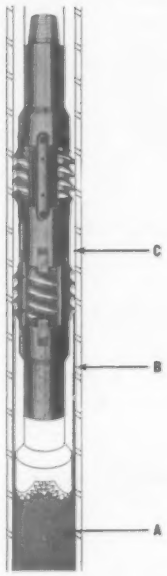
"The other side of the coin is a bit obscure but we can see dimly a tempting pastoral scene with thousands of old workhorses turned out in green pastures, which are often proving to be mirages.

"Creativity, judgment, and even enthusiasm are not always a matter of age. It is impossible to judge the amount of lead in the seat of the pants by the color of a man's hair or the style of his haircut.

"In recent policies of the oil industry relating to the conservation of experience and skills, one is reminded of the days when it was considered, in some quarters, to be smart to plow under the little pigs. It takes much longer to make an experienced and skilled workman in any field than it does to make a pig."

—Henry D. Ralph

your WELL'S FUTURE LOOKS GOOD when the "WORKING SURFACE" of the CASING is CLEAN!



A – Cement to be drilled out.
B – This thin cement sheath, which remains after the bit has passed, often interferes with future operations.
C – Cement sheath and ALL other obstructions removed by the Baker ROTO-Vert Casing Scraper. The vital I. D. of the casing is left clean and smooth, safe for all future down-hole operations.

It's simple and inexpensive to run a Baker Casing Scraper just above the bit when drilling out cement, or following perforating operations, to provide a bright future for your well.

No obstructions will remain to cause premature setting of close-tolerance tools. Rust, mill scale and paraffin will be scraped away, and there will not be any sharp burrs to slash and ruin swab rubbers or affect the performance of packing elements on testers, packers and cement retainers. Even the thin, brittle cement sheath which prevents the slips of pack-off tools from gripping the casing, are scraped away.

Thousands of runs have proved the Baker ROTO-VERT Casing Scraper to be both positive and safe in cleaning up casing I. D. easily and at low cost.

Available from the Baker Servicepoint in your area, on a rental basis.

BAKER OIL TOOLS, INC. · HOUSTON · LOS ANGELES · NEW YORK

Is Texas preparing to modernize regulation?

WHEN A GROUP of small producers agrees that allowable formulas which favor small wells cause inequities which need correcting, it is worthy of note.

But when that group is the Texas Independent Producers and Royalty Owners Association, the announcement is significant news.

It indicates that Texas may be getting ready to abandon some archaic features of its conservation laws and to get in line with other producing states whose practices are better adapted to conditions in today's oil business.

THE BIG PROBLEM facing all state conservation bodies is the perfecting of regulatory practices to increase the producing industry's over-all efficiency during this period of low increase in demand and high excess producing capacity.

No state has completely achieved this, but probably the outstanding deficiency is Texas' lack of provision for pooling surface interests within a drilling unit. This fosters economic waste in drilling unnecessary wells, causes inequitable reservoir drainage and impairment of correlative rights, and undermines the ability of the allowables system to allocate market demand fairly.

In times like the present it is virtually an economic crime to drill wells for an allowable instead of to discover more oil and gas or to produce them more efficiently, yet that is the result of an allowables formula which invites close well spacing and drilling on small tracts.

Newer producing states have avoided this by intelligent coordination of spacing and allowables rules, but Texas independents have adamantly refused to admit that the pooling arrangements successfully used elsewhere can protect individual rights while serving the public interest.

Now TIPRO has in large part reversed its stand. It is willing to consider objectively, if not embrace openly, some newer concepts.

This switch was accomplished by many months of strenuous self-education among the members of the association. This program is to continue, and during coming months TIPRO will study how pooling, spacing, unitization, and allowables practices operate in other states.

THIS EXAMPLE should encourage producers in other states to conduct similar self-education programs on how to adapt the industry to today's difficult economic conditions.

Producers in some states have been as obstinate in refusing to consider market-demand proration as have Texans in closing their eyes to pooling, though proration is just as essential as wide spacing as a means of coping with excess producing capacity.

The essential thing is to recognize that conservation is not static but that regulatory practices must constantly be altered to keep the industry virile and adapted to economic realities.

PLICO

thanks to you... *we've expanded!*

PLICO PIPELINE INSULATING SPACERS

BECAUSE OF YOUR SUPPORT OVER THE PAST YEARS, we've been able to expand our facilities at PLICO...a new and bigger plant...a new address...better-than-ever service! The one and only original PLICO Pipeline Insulating Spacer has never been equaled for protection against shorting between casing and carrier. It is easily installed in the field; features an exclusive rugged design that prevents cold flow or coating damage; serves dependably—even under environmental extremes—throughout its long service life. *Write or phone TODAY for complete information.*

DISTRIBUTOR INQUIRIES INVITED

PLICO

MARWAIS MANUFACTURING DIVISION
A DIVISION OF MARWAIS STEEL CO.

New Address: 6466 Gayhart Street • Los Angeles 22 • California
New Telephone: RAymond 3-8831

Aromatics Outlook: Surplus But No Glut

• There may be some products surplus in 1962, but not enough to turn markets upside down. Built-in flexibility helps aromatics producers.

Hugh Pylant and Ken Brooks, Journal Staff

THERE'LL BE a surplus of aromatics next year, but it won't be an alarming one.

For the past year there have been dire predictions that the industry's current building boom would burden producers with a glut of unsalable aromatics.

It doesn't look that way now. It's true that plants coming on stream next year will push capacity well beyond actual demand. But it appears that processors can run their plants at 80 to 85% of capacity—enough for a payout—without piling up a big product surplus.

Aromatics producers have one advantage over other processing people—a helpful built-in flexibility. If there should be too much benzene, for example, a producer can switch his operations to produce any one of a number of aromatics.

There's been another encouraging development, too. Overseas demand is increasing at a greater rate than was expected a year or so ago.

All this means that, while there may be some product surplus, it won't be big enough to threaten the industry's economics.

Here's a quick look at aromatics' markets:

Benzene . . . Output in 1960 was more than 450 million gallons. Demand, including exports, should come close to 600 million gallons in 1962 and climb to 750 to 850 million in 1965.

New construction should push capacity to 850 million gallons in 1962 and probably a billion gallons in 1965.

This surplus capacity shouldn't prove too serious. Plant operation at 80 to 85% of capacity would leave a surplus of only 40 to 80 million gallons.

There will be some market changes, however. Use of benzene to make nylon and detergents has been leveling off at an annual growth rate of 3 to 5%. In the future, the big markets will be styrene and phenol.

In styrene manufacture, though, there is a threat of competition. Superfractionation of mixed xylene streams, it appears, can produce ethylbenzene for styrene production more cheaply than can alkylation of benzene. If so, the xylenes could cut into the market. The limiting factor will be availability of ethylbenzene in mixed xylene streams.

Toluene . . . Production last year was about 300 million gallons. It should top 500 million in 1965.

Capacity of toluene facilities isn't much greater than market demand. Surplus capacity last year was about 50 million gallons.

More than half of last year's production went into gasoline blending. This use is likely to drop in the future, but the demand for dealkylating into benzene should more than offset the decline.

There are no other large outlets for toluene. Some small quantities go into solvents, diisocyanates and detergents.

Xylenes . . . As a whole, this group is similar to toluene. Production last year was a little more than 300 million gallons, which was close to capacity.

Also like toluene, the largest use

A Quick Look at the Aromatics:

Benzene—Major uses are in making styrene, phenol, nylon, and detergents. Production in 1960: over 450 million gallons. Outlook by 1965: an estimated 75% gain.

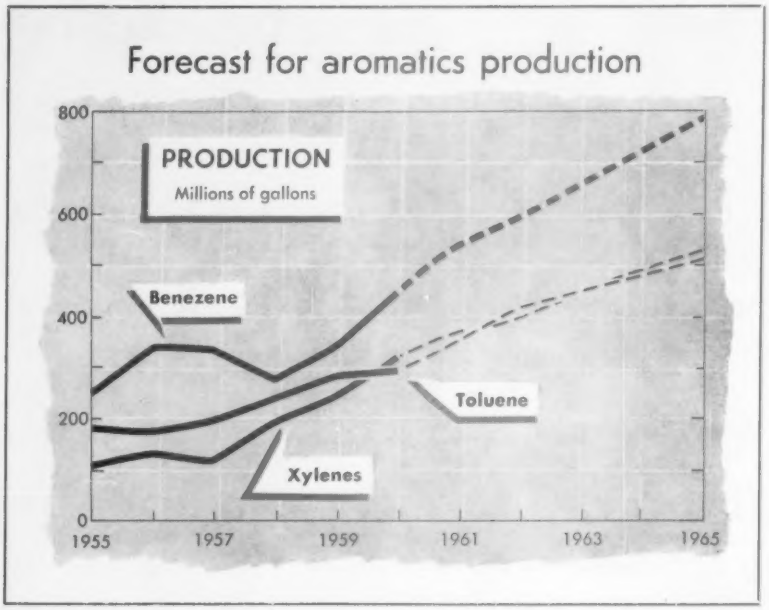
Toluene—Used mostly for gasoline blending. Production in 1960: nearly 300 million gallons. Outlook by 1965: Increase of 60% or greater, with more being dealkylated into benzene.

Mixed xylenes—Used mostly for gasoline blending. Production in 1960: 320 million gallons. Outlook by 1965: More than a 60% increase. About 15% is separated into the isomers below.

Orthoxylene—Mostly goes overseas for phthalic anhydride production. Production in 1960: 18 million gallons. Outlook by 1965: Almost 300% increase.

Paraxylene—Used primarily in making polyester fibers. Production in 1960: 25 million gallons. Outlook by 1965: A 100% increase.

Metaxylene—Used to some extent in making plasticizers. Production in 1960: 5 million gallons. Outlook by 1965: About a 60% increase.



is blending in gasoline. Consumption of xylenes is expected to increase to well over 500 million gallons in 1965. The bright spot in the future is the potential in the chemical markets for the various xylene isomers:

. . . **Orthoxylene** finds its primary markets now overseas for producing phthalic anhydride. But big domestic markets may develop. There are new processes using new catalysts which get about a 20% better yield from orthoxylene than from naphthalene. And ortho, at 5 cents a pound, is much more attractive than naphthalene at 7 cents.

Foreign demand for ortho should grow faster than foreign capacity, so the export market should remain good for some time.

. . . **Paraxylene,** used primarily to make terephthalic acid, is used mostly by Du Pont in making polyester fibers. Production is running about 250 million gallons.

. . . **Metaxylene** has a small, but growing, market in producing isophthalic acid. It soon may become cheap enough that isophthalic can compete for phthalic markets. In the meantime, some meta is being recycled back to hydroformers to form more ortho and paraxylene.

Flexible output . . . One of the big checks against a huge surplus of capacity in any one product is the refiner's ability to change his operations to meet a changing market.

Catalytic reforming of straightrun naphthenic fractions is the greatest source of aromatics and offers the greatest flexibility.

By tailoring the feed stock to the reformer, the refiner can produce only those aromatics blessed with a good market. This can be done in a number of ways:

. . . **Fractionate** the feed so that it contains only those naphthenes which can be converted to the desired product. For instance, a 140° to 190° F. boiling-range feed will produce mostly benzene. A 185° to 200° stock is used for toluene production, and if xylenes were desired also the range would be extended to 270°.

. . . **Charge** a full-boiling-range naphtha to the reformer. Selected fractions of the reformate can then be extracted to produce higher aromatics. The rest is sent to the gasoline pool.

. . . **Blocked-out** operation of the reformer. The refiner can tailor his feed stocks to produce aromatics only part of the time, operating the rest of the time for gasoline production.

In any case the refiner has control over both the type and the volume of aromatics produced.

Udex boom . . . Aromatics in the reformate are recovered and purified by a number of available processes, including adsorption, fractional or extractive distillation, azeotropic distillation, crystallization, and solvent extraction.

There has been a boom lately in solvent extraction, mainly through Universal Oil Products Co.'s Udex process.

Where this equipment has been installed primarily for benzene production, it has usually been found necessary to have a market also for byproduct toluene and xylenes.

Since the refiner can't just sell the benzene and blend the others to gasoline, this factor tends to limit the amount of benzene produced.

Hydrodealkylation . . . Plants using these units would likely feel the first pinch of a price war in the benzene market.

In converting toluene into benzene, they are the least flexible of the aromatics producers. Generally, the processor must maintain a price differential of 12 to 14 cents a gallon between raw material and end product to assure a payout of facilities in a reasonable time.

Some of this capacity could be switched over to naphthalene production. According to the market situation, feed stocks to hydrodealkylation units can be varied from toluene to the heavier alkyl naphthalenes to produce primarily benzene or naphthalene, or a combination of both.

Dry hole breaks Soldotna Creek's perfect record

A DRY HOLE finally has been drilled in the Soldotna Creek unit of Alaska's Swanson River field.

The discovery well in Soldotna Creek was completed in March 1960. A string of 14 producers was completed before the SCU 12-16 was plugged and abandoned at a total depth of 12,759 ft.

Soldotna Creek and Swanson River unit make up the two pools which comprise Swanson River field. Soldotna Creek is the southern part of the field.

The recent dry hole is only the third drilled in the field, which includes 27 producing wells. One gas well also has been completed in the field.

Standard Oil Co. of California is operator in the field. Richfield Oil Corp. is the other major leaseholder.

Crude Capacity Set at 10,585,000 Bbl.

THE nation's crude-oil productive capacity on January 1, 1960, was 10,585,000 bbl. daily, the National Petroleum Council estimated in a report made public this week.

By PAD districts, the estimated capacities, in thousands of barrels daily, are:

East Coast, 29; Mid-Continent, 1,555; Gulf Coast, 7,331; Rocky Mountain, 664; and West Coast, 1,006.

By comparison, an estimate for the same date of 9,708,000 bbl. daily in the productive capacity of crude oil and lease condensate was made recently by the Productive Capacity Committee of the Independent Petroleum Association of America (OGJ, May 8, p. 77).

Other estimates in the current NPC report include: Natural - gas liquids, 1,799,000 bbl. daily, and natural gas, 71.5 billion cubic feet daily.

These are estimates of potential capacity rather than actual availability. Thus, no consideration is given to any governmental restrictions or to limitations on existing facilities for processing, storage, or transportation.

NPC said the present study indicates an increase of crude-oil productive capacity since January 1, 1957, of 718,000 bbl. a day—an annual increase during the 3-year period of 238,000 bbl. daily.

The committee also estimated that it would be necessary to drill from 40,000 to 50,000 wells a year, including 20,000 to 25,000 oil wells, to maintain the 10,585,000 bbl. daily productive capacity until January 1, 1962.

Without drilling, the committee estimates that the capacity would decline to 8,905,000 bbl. daily by the start of 1962.

The NPC report also presents historical tabulations of proved discoveries of crude oil, natural gas, and natural-gas liquids in the U. S., summarized by PAD districts.

The study, requested by Interior Department, was done by the council's committee on proved petroleum and natural gas reserves and availability.

Copies of the 56-page report are available at the National Petroleum Council, 1625 K Street, N.W., Washington 6, D. C.

Gulf Automates Its Credit-Card Business

GULF OIL Corp. is moving toward an automatic credit-card operation from the service-station sale to the mail delivery of the monthly bill.

Gulf marketing vice president J. L. Lenker last week confirmed reports that his company is buying more than 25,000 Addressograph imprinters and four high-speed card-processing scanners.

The equipment will cost Gulf about $2,250,000, but equipment manufacturers estimate that the unit will reduce clerical help by nearly 40%. Delivery of the equipment will begin about June 1.

Lenker said the move is an attempt to reduce the soaring costs of handling credit-card business.

The big cost has been the large clerical staff needed to handle the thousands of credit slips which come in daily from service stations throughout a marketing area.

Using the imprinter, the station attendant inserts the credit card, then moves levers to register the amount of the purchase. The machine produces a coded card which is sent to one of Gulf's four regional billing centers. There the automatic scanners will take over, sorting the cards into customer accounts. Automatic billing follows in a second operation.

IMPRINTER eliminates handwritten sales figures, prepares a statement that can be read by machine. From this point, all credit work is automatic.

Gulf has been using some of the imprinters experimentally in its Gulf Coast region for the past 6 months. Several other majors with large credit-card business also are studying fully automatic operations.

Many already have installed punched-card equipment in their billing centers, but Gulf is the first to extend automation to the station.

How Jersey Solves Operating Problems

Mathematical study aids planning in many oil areas.

Showing has led Esso Research to form math division.

Gene T. Kinney
East Coast Editor

TECHNICIANS of new applied-mathematics division work on a dynamic-chemical-engineering problem involving systems engineering control of a fractionating tower. Other console contains model of thermal-cracking unit.

HIGHER MATHEMATICS is playing an increasing role in the solution of a wide range of oil-industry operating problems.

The growing importance and stature of this tool are reflected in a new applied-mathematics division of Esso Research & Engineering Co., the central research affiliate of Standard Oil Co. (N. J.).

Creation of the division moves applied mathematics up the status ladder.

Two activities — operations research and a computer center — were merged to make the new division.

Since 1956, operations research had been part of the research company's process-engineering division. The computer center, organized in 1957, had been part of the petroleum-development division.

Now the merger into a single applied-mathematics division has put the two activities on an organizational par with the process-engineering and petroleum-development groups. The director of the new division reports to the vice president for engineering.

The math division is shy about putting a dollar value on the hundreds of jobs handled by its separate components before the merger. But the two branches probably "saved" or "made" millions of dollars for Jersey.

Their work helped achieve better scheduling and planning, an improved balance in manufacturing units, and more accurate sizing and location of plant facilities.

Process-engineering knowledge also has been advanced by the mathematical program and the use of electronic computers.

Applications . . . The math group tackles all manner of jobs.

Name a problem and the operations-research and computer groups have probably developed a technique for mathematical solution.

Main condition: The problem must occur often enough to justify programing.

The value of applied mathematics is illustrated in these Esso Research examples:

. . . Engineering investment. Two of the major projects that have been undertaken are large-scale simulation models built for Trans-Arabian Pipe Line Co. and the La Salina marine terminal in Venezuela.

These models can quickly examine proposed expansions to determine their effect on revenue and tanker loading.

In the case of either installation, expansion would run into millions of dollars. The risk of ending up with undersized facilities could be great, too.

Take the case of the La Salina terminal, which loads up to a million barrels daily of crude oil.

If an estimate of needs for new tanks or tanker berths erred on the high side, it would result in an unnecessary outlay of $4 million to $8 million. An error in the other direction could mean expensive delays and lost business.

But how does a manager know whether computer calculations are realistic?

The Trans-Arabian and La Salina models have been proved by historical checks. Each was fed data obtained in previous situations. And each gave answers that were borne out by the actual behavior of the pipeline and terminals under those conditions.

These are classic examples of operations-research and computer applications. They involve such a large number of interacting variables that manual mathematical solutions are not feasible.

Through the use of computers as engineering aids at the recently completed Esso refinery in Slagen, Norway, almost half a million dollars was saved in engineering man-

With Math

hours and equipment expenditures.

Portions of this refinery were designed with the help of computer programs that estimated costs and solved problems in process planning and mechanical design. A program to simulate marine-terminal operations cut costs of piping, pumps, and docking facilities.

Even the strain on ships' hawsers under varying conditions of wind and tide was calculated to give the best mooring system at the lowest price.

. . . **Manufacturing.** A typical operations-research project is the development of an over-all mathematical model of a refinery.

With this model, engineers can consider all operating alternatives and figure out the best running plan. This would include details of alternative crudes, operating conditions, product-blending methods, and product volumes.

The applied-mathematics division is working on an important extension to this type of application. The project would link several refineries by controlling crude supplies and product distributions to achieve the most efficient over-all operation.

In the field of reaction kinetics, what was formerly a research project has been reduced to a normal design procedure.

Typical of the analog-computer applications are the problems which were being run when a reporter visited the computer center.

One involved thermal-cracking yields. Operators were changing variables to see what would happen.

It was almost like watching the real thing.

On the second of the two computer boards, systems-engineering control of the overhead reflux return of a fractionating tower was being studied in the same manner.

. . . **Transportation.** Members of the math group also devised a computer program which is now being used to oversee scheduling of a tanker fleet moving refined products to 11 dockside terminals.

The computer program is the basis for assigning each ship and determining its cargo on a given voyage. The program considers inventories and each ship's characteristics and sailing times to figure the minimum-cost cargo and destination.

. . . **Research and development.** The applied-mathematics division was a factor in the recent development by Esso Research of a new use for petroleum products.

This is in the operation of blast furnaces, which could become an important market for fuel oil and natural gas.

The scientists and engineers on the team provided the physical-science technology. The mathematicians provided techniques for handling the enormous volume of calculations required.

Operation of a blast furnace was simulated on a digital computer and the effects of the addition of liquid or gaseous hydrocarbons were predicted.

Division activities . . . There are four activities within the applied-mathematics division:

. . . **Operations research.**

. . . **Computer center.**

. . . **Computer technical-consulting** service.

. . . **Applied-mathematics** research and development.

Operations research has been defined in many terms, some of them bordering on the mystical. But Esso Research people refer to it simply as the application to operating problems of modern mathematical procedures, computing knowledge, and the scientific method.

The computer center has two large computers.

One is an IBM 7090 digital computer, the largest industrial machine in use and one of the few in the

Key Men of New Division Are Veteran Researchers

Connor Taylor Nelson

THREE SCIENTISTS with plenty of experience in research and engineering management set the pace for the applied-mathematics division of Esso Research & Engineering Co.

Dr. Channing Nelson, division director, holds BS and PhD degrees in chemistry from Cornell University. Since starting with Esso Research in 1939, he has been senior project engineer, supervising engineer, director of the design-engineering division, and director of the general-engineering division.

Myles J. Connor, Jr., assistant division director, has a BS in mechanical engineering from Rutgers University and an MS in the same field from Columbia University. He joined Esso Research in 1948 and has been responsible for operations research since its inception in 1956.

Dr. John F. Taylor, assistant division director, is a chemical engineer. He took his BS from Louisiana State University, and his MS and PhD degrees from the University of Illinois, and joined Esso Research in 1955. Taylor headed a section in the process-engineering division of Esso Research until his recent appointment as chief of the computing center.

petroleum industry thus far. The other is a two-console Electronics Associates Type 231-R analog computer.

The consulting service provides a technical staff to help clients devise a program for computer application.

Research and development staff members provide a backup for the technical divisions or company affiliates. If available tools won't solve a problem, they create new ones that will.

Mission . . . "Our primary function," explains Dr. Channing Nelson, director of the division, "is to determine the economic incentive and promote the use of mathematical procedures and machine techniques wherever economic in the worldwide Jersey Standard organization."

The division takes the initiative in suggesting to an affiliate of the parent company:

"You have a problem, we have the technique to get a better answer, why not ask us to help you?"

Overcoming skepticism . . . If the division has one problem that overshadows all others, it is probably that of human conservatism.

Although operations-research and electronic computers have been around for some years now, their application is by no means completely developed. It is a rare engineer or manager who has not been chary of their results, and the burden of proof is properly on the applied-mathematics division.

"We are introducing a new type of technology, and so we naturally run into a highly skeptical human response," Nelson says. "Ours is a field with a complex and strange jargon.

"We are asking people in a management capacity to accept a new tool which most don't have the time to take to understand thoroughly. There is a sincere fear that machines and the operations-research approach won't give a correct answer.

"We are also working near delicate areas of management prerogative. Of course, operations research doesn't tell anyone what to do. In areas where it is applicable, it does put management in a better position to make a decision—particularly with respect to capital investment."

Division staff . . . The new division is staffed with personnel skilled in applied mathematics.

There are no pure mathematicians in the classical sense. Among the 30 professionals in the division, the typical member has one or more degrees in an engineering discipline. This is usually augmented by graduate work.

Permian Petrochem Boom Seen

- NGAA told basin's petrochemical growth record, top-flight resources favor new gains.

LOOK FOR BOOMING growth in petrochemical production in the Permian basin.

That's the message from Jesse L. Owens, manager of chemical activities for El Paso Natural Gas Products Co., El Paso, Tex.

At the Permian basin regional meeting of the Natural Gasoline Association of America in Odessa May 12, Owens pointed out that in just 6 years the basin has become a well-established petrochemical-manufacturing center.

He estimated gross investment in the basin's chemical manufacturing during the period at more than $60,000,000. New plants under construction or scheduled will boost this investment by another $75,000,000

More to come . . . All this construction, Owens said, puts the industry in a strong position to sustain petrochemical growth in the basin.

Historically, the growth of petrochemical complexes has been linked to the availability of cheap chemical building blocks and intermediates required for processing.

"The Permian basin now has available some of the most important of these building blocks—such as benzene and other aromatics, ethylene, propylene, and heavier olefins and diolefins like butadiene and styrene," Owens told his audience.

It also has a supply of important inorganics such as sulfur, caustic, and chlorine.

Other basic assets . . . Owens said the basin also has these assets which will attract new petrochemical plants:

. . . Raw materials. Natural gas and light hydrocarbon fractions are abundant and cost 10 to 20% less than in other major chemical-producing markets.

. . . Water. Though the cost is high, an adequate supply of water is available.

. . . Labor. The basin's labor force ranks among the best in the U. S. from the standpoint of skills, productivity, and excellent labor-management relations. Plants can be built and operated more efficiently here because of this condition.

. . . Electricity. Electricity is available in quantity and at highly competitive prices.

. . . Supply and service facilities Many facilities that were developed in the basin to serve the oil industry adapt well to chemical-plant operations. This reduces plant maintenance and inventory burdens.

Liabilities . . . The basin has some liabilities, Owens said, but they're not as numerous as its advantages. Among the liabilities: The area's distance from its major chemical markets and resulting freight costs.

The major freight-cost disadvantage lies in movement to the West Coast and to export points, Owens said. However, rates to the Midwest and northeastern markets are competitive with rates from the Gulf Coast to these areas.

Profit is there . . . Owens cited a recent statement by R. L. Tollett, president of Cosden Petroleum Corp., Big Spring, Tex., as evidence of profit in basin petrochemical operations.

Tollett said 18% of Cosden's net profit currently comes from its petrochemical operations, although it upgrades into chemicals only 4% of each barrel of crude oil processed at its Big Spring and Colorado City refineries.

Drilling Pushed in Promising Alberta Fields

• Eight rigs are at work in the lush Waterton Park-Pincher Creek area, which ranks among Canada's top gas prospects. Shell is building a processing plant at Waterton, and exports to California and Montana are slated.

EIGHT WELLS are drilling in the Waterton Park - Pincher Creek area of southwestern Alberta, one of Canada's biggest and most important gas-export districts.

This play represents a tenth of all drilling activity in the country. Only 80 rigs are working throughout Canada at present.

More than a score of wells have been completed in the Waterton Park, Pincher Creek, and Lookout Butte fields which lie close to each other in the prolific corner of Alberta.

With one exception, all production in the Waterton Park-Pincher Creek area is from Mississippian. Shell-Calalta 6-12 Carbondale is a Devonian well.

The first stepout to the Devonian well has been announced by Shell Oil Co. of Canada, Ltd. (upper left on map). Drilling will begin soon.

Waterton Park drilling . . . Shell already has five other wells drilling in Waterton Park field. Pan American is drilling one.

Shell wants to prove further reserves and to clear the way for production by the end of the year.

The company is constructing a gas-processing plant in the area. Capacity will be 120 million cubic feet daily.

Waterton Park will produce gas for the export facilities of Alberta & Southern Gas Co., Ltd., for delivery to California and to the Montana Power Co. for Montana use (OGJ, April 10, p. 80).

Pincher Creek status . . . The giant Pincher Creek field is tied into the Alberta Gas Trunk Line Co. system and thus to the Trans-Canada Pipe Lines, Ltd., export line to eastern Canada and the U. S. Midwest.

British American Oil Co. has a gas-processing plant with a capacity of 204 million cubic feet daily in Pincher Creek.

The company is drilling two wells in the field.

Lookout Butte development . . . The big Lookout Butte field lies south of Pincher Creek and is only 3 miles north of the U. S. border. It promises to be a gas giant.

Both Shell and British American have production from Mississippian in the field.

Shell has one prolific wet-gas well in Lookout Butte. British American has two. The area has not been hooked up.

Only further development will tell whether a separate plant is needed for processing.

Construction slowup . . . Meanwhile, two valuable natural-gas fields in northern British Columbia have almost been isolated. Ice knocked out a bridge over the Sikanni River, 700 miles north of Vancouver.

The $280,000 bridge at Mile 300 on the Alaska Highway had been expected to play an important part in the planned program of pipeline construction and summer drilling at the Clarke and Kotcho Lake fields.

An $11-million natural-gas-gathering system had been scheduled for completion in the area this year. But materials can't be transported to the fields until highway service is restored, and the completion date for the gathering system may have to be moved to late 1962.

The Kotcho Lake field, where Gulf States Oil of Canada has big holdings, is reported to be one of the hottest fields in North America.

The new gathering system would carry gas from the area to refineries near Fort St. John, B. C., northern terminus of the West Coast Transmission Co. line which delivers gas to the lower section of British Columbia and the Pacific Northwest states.

Coal Industry Seeks Oil's Help Against

- New proposal in anti-imports campaign: Alliance between independent oil operators and coal industry. Coal spokesman warns that if imports of crude and resid keep making inroads, domestic oil-and-coal markets will be ruined.

INDEPENDENT producers were wooed ardently in Midland, Tex., last week by spokesmen for the coal industry and for New England gas consumers.

Coal urged an alliance between independent oil operators and the coal industry to thwart oil imports—especially those of residual fuel. The wooer on this issue was Joseph E. Moody, president of the National Coal Policy Conference.

Rep. Torbert H. Macdonald (D.-Mass.), pushing for support of his gas bill exempting small producers from federal regulation, declared both independents and New England consumers are "victims of the ever-growing power of the integrated pipeline companies."

Moody was a participant in a panel on national energy policy during the fifteenth annual meeting of the Texas Independent Producers and Royalty Owners Association.

He based his pitch for independent support on the premise that the domestic oil and coal industries will be destroyed if imports continue to absorb more of the U. S. market.

Joseph E. Moody
. . . "No tricks in national fuels study."

"Our proposal for a fuels study by the Congress of the United States has no tricks in it; we have no preconceived ideas of its results. We have only a faith in the American people looking at American problems," he said.

"Somewhere in the very near future, a decision has to be made as to whether we will continue to have strong and vigorous domestic-fuels industries, or not. That has to be a government decision.

"Left alone, the domestic industries can compete only to a certain limited point beyond which the imported foreign fuels, having no actual cost relationship with domestic fuels, will overrun our markets.

"This trend, which is now underway, must be halted or it will eventually destroy us."

Imports inseparable . . . Imports of crude oil and of residual fuel, Moody said, are inseparable.

He said the coal industry has been accused of complaining about something that represents only about a 10% equivalent of its national annual production.

Rep. Torbert Macdonald
. . . "Not wedded to 2 billion cubic feet."

"But this 10% affects our whole sales and pricing structure," Moody declared.

"This is also true in the case of

TIPRO Eases Stand on Texas Spacing

TIPRO last week confirmed again its historical stand against compulsory unitization but mellowed former policy against any change in Texas spacing practices.

The long-awaited report by TIPRO's unitization committee, submitted after more than 4 months of heated debate, made no drastic changes.

The report, as amended and approved by the annual convention in Midland last week, commits the association to:

. . . Push for temporary field rules following oil or gas discoveries.

. . . Aid the Texas Railroad Commission "in any way possible in any effort it may make to correct inequities caused by drilling on tracts smaller than regular proration units when all property rights can be protected by other means."

. . . Review pooling laws of Oklahoma, Louisiana, Arkansas, and other states and report the findings to the unitization committee.

. . . Oppose compulsory fieldwide unitization and encourage voluntary unitization.

Regarding temporary spacing, the association urged the Texas Railroad Commission to adopt this proposed rule:

"As soon as the potential for the discovery natural-gas or oil well is filed, the operator may file for temporary field rules. These rules would become permanent after five wells are drilled in the field, unless, within a reasonable time, an application for a hearing on permanent rules shall be made."

Fuel Imports

crude oil. Imported crude represents only about 10% of domestic crude production — but it affects every barrel of domestic production regardless of where it is produced."

"There is good reason to believe," Moody argued, "that any of the majors in the international oil game could put almost unlimited supplies of foreign crude at the head of the ship channel in Houston at well below one-half the cost of any Texas-produced crude.

"There is also every reason to believe that these majors are pushing hard for that day when they can control the entire fuel economy of the United States," he said.

Cutoff negotiable? . . . In making a pitch for independent producer support of his decontrol bill for small gas producers, Macdonald hinted strongly that the 2-billion-cubic-foot cutoff point could be adjusted upwards.

"Certainly," he told his audience, "I have no great self-pride of authorship in each and every detail of this bill. And there is nothing sacred about the figure of 2 billion cubic feet as a cutoff for federal regulation. I would further welcome any further suggestions that you might have on this subject."

The New England congressman hit hard at the "industry-unity" concept. He said he wondered whether this might not be a smoke screen thrown up by major producers out of selfish motives.

"Why is it that independent producers would not want to be exempt from federal regulation if, as they indicate and I believe, such regulation is a burden on their industry?" Macdonald asked.

"The bill which I have introduced is a simple bill. It seems to me to be an effective bill . . . which would do justice to you independent producers and yet give protection to the consumer."

The TIPRO convention adjourned without official action on either this or any other proposed gas bill. It simply charged its executive committee to keep close tabs on the legislative situation and continuing to work for a producer-decontrol bill.

watching WASHINGTON

Clyde La Motte

• What changes will be made in import control plan? . . .

IT IS THE GUESS from this corner that:

. . . Producers will benefit most from any changes Interior may eventually make in the crude-oil import program.

. . . Historical importers will bear the brunt of any reduction in present levels or adjustments made to relate imports to domestic-crude production.

. . . Quota swapping by inland refiners will continue, but there may be closer inspection to make sure quotas are not sold outright.

. . . Sliding-scale quotas will remain, although adjustments may be made in the percentages.

Bear in mind that the above is what one observer saw while gazing into a crystal ball that had become slightly cloudy during 2 long days of hearings in Washington.

There is nothing to indicate that Interior officials had their minds made up before the hearings started—or that they have yet reached any conclusions.

They plan to settle down this week to the man-sized chore of wading through all the suggestions and objections presented by the industry.

They would like to get the issues settled before the next 6-month period begins July 1, but they are not optimistic. Of course, they could make changes in the current program later in the year.

• Barter plan for military oil fails on first try . . .

THE MILITARY didn't receive any acceptable bids in its first attempt to barter surplus U. S. agricultural commodities for its offshore oil purchases.

As a result, the Military Petroleum Supply Agency is now seeking 6.2-million barrels of navy special in the normal bid manner—with no barter involved.

Don't write off the barter plan entirely, however. It probably will be tried again later, perhaps on another product and on a somewhat different basis.

• There may be some gas legislation this year, but . . .

A CONGRESSIONAL committee will begin consideration of some gas legislation proposals next week, but they won't be gas industry proposals.

The Senate Commerce Committee will hold hearings on bills drafted by the National Association of Railway and Utility Commissioners (NARUC).

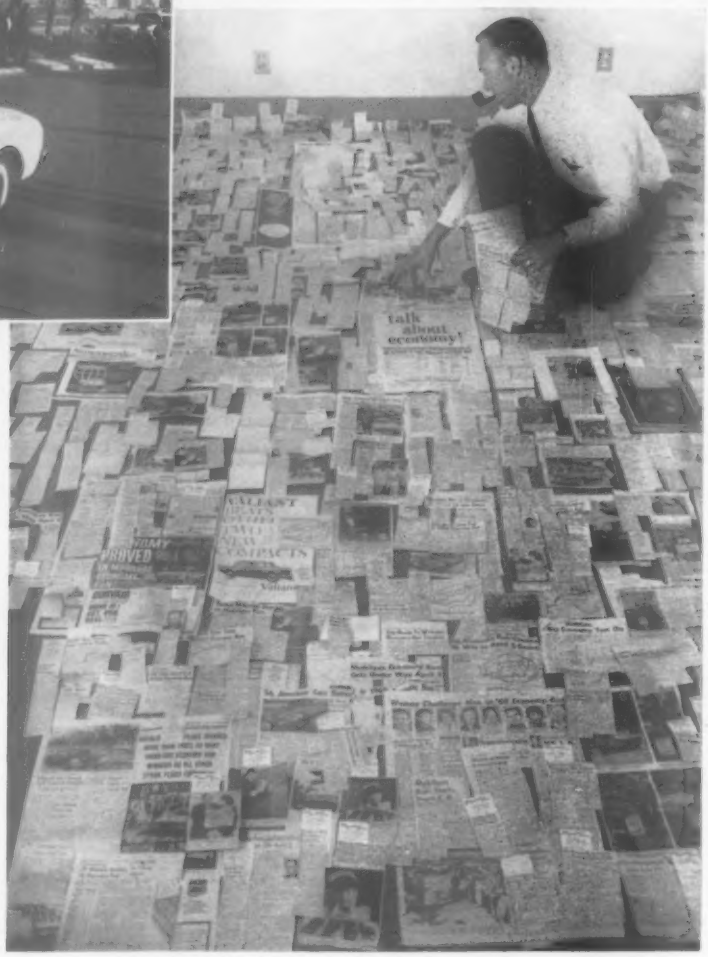
The NARUC proposals would ban: Indefinite pricing clauses; filing of rate increases as long as a previous rate hike proposal is still pending, and certifying of projects before FPC has made a finding that the price of gas involved "would be consistent with public interest."

All in all, the NARUC suggestions are about as far away from what the industry would like as one can get.

Indications are, too, that the committee will limit its hearings to the NARUC bills.

This does not mean that other proposals would not get consideration later, either by this committee or its House counterpart. But so far no concerted push has been given to any counter legislation.

Best-known marketing promotion . . .



Reaps a tremendous volume of name-brand publicity.

Mobil Sells Economy—And Gets Bonus

SPENDING thousands of dollars showing your customers how to use less of your product doesn't sound like good business.

Yet Socony Mobil Oil Co. has been doing just that with its Mobilgas Economy Run—the biggest and best-known of all marketing promotions.

For 25 years Socony has been showing the motorist how to get more miles per gallon. It's a cinch, admits Frank Meunier, manager of Socony Mobil's product-promotion department, "that someone thinks we're nuts."

But, for every run it stages, the company gets back many times the cost in millions of dollars worth of free publicity and in collateral advertising by car manufacturers and others.

The publicity returns for the 1961 Los Angeles-Chicago run aren't in yet. But they're piling up at a rate which indicates Mobil's rewards this year will be the biggest in history.

If so, they'll mean a real performance. Here's the payoff on the run:

. . . **More than 15,000 stories** printed by newspapers from Bangor, Me., to San Diego, Calif.

. . . **Over 300 magazines** carried articles and pictures.

. . . **32,000,000 persons,** at least, saw or heard about the run on television and radio newscasts.

. . . **More than 62,000,000** saw commercials based on the run on national television shows.

. . . **$7,000,000 worth of ads** via newspapers, radio, and television were run and paid for by automobile manufacturers sponsoring class-winning cars. These same car makers also made vigorous use of window displays and special dealer promotions capitalizing on the performances of their cars in the run. Manufacturers of spark plugs and other auto components added to the advertising barrage.

All this was in addition to the extensive advertising that Mobil itself built around the event.

Sales springboard . . . The upshot is tremendous visibility for the Mo-

bilgas brand. It is mentioned and rementioned in every article, broadcast, and advertisement.

This is why Mobil feels it gets more "extra mileage" from its run than any of the participating cars.

Meunier, who also directs Mobil's participation in the Indianapolis 500, and about 100 other events, terms the run "one of the industry's best sales springboards."

Mobil sprang off that board this spring with a $100,000 "Mobilgas Economy Run Sweepstakes." The contest, just ended, is aimed at building traffic at Mobil stations. The company is following up the avalanche of publicity from the run with a heavy schedule of tie-in advertising for the contest.

Impact lasts . . . Mobil has convincing evidence that auto owners don't quickly forget about the run once the publicity subsides.

A survey 2 years ago, the company says, "showed that more than 60% of the adult population of the country knew about the run and who sponsors it."

Another factor that makes the run even more valuable in Mobil eyes is the motoring public's increasing interest in driving economy—as best expressed in the tremendous surge in sales of compact cars.

Are gas sales really cut? . . . That Mobil really benefits from the run in many ways is quite obvious.

But how about this business of showing motorists how to use less gasoline?

Not very many of them, the company thinks, actually use what the run shows them about driving economy. The driver doesn't want to be bothered with the inconvenience that goes with the economy. About the only time he does apply this knowledge, Mobil says, is in an emergency.

Nevertheless, Mobil marketers feel the company is furnishing a genuine service. "It is never imprudent," one official says, "for a company to demonstrate how its product can be used most efficiently or safely."

And then the economy feature has another side which may be of greater benefit to the driver.

The run furnishes a yardstick for measuring the driving economy of each year's crop of new cars. Each car has to contend with the same conditions. And the run spotlights innovations bearing on economy.

Conoco Lease Challenged

- Justice Department suit charges company violated antimerger rules by acquiring Malco Refineries.

CONTINENTAL Oil Co.'s lease of Malco Refineries, Inc., of Roswell, N. M., in 1959 is now being challenged by the U. S. Department of Justice.

Justice has filed a complaint in the U. S. District Court in Albuquerque, charging that Continental violated antimerger provisions of the Clayton Act.

The Government is seeking to force Continental to establish "an independent, competing firm" out of the assets acquired from Malco.

Reason for the suit, according to the Justice Department, is that Continental's action in acquiring Malco "may have served to lessen competition or tend to create a monopoly."

Justice pointed out that Malco was the largest of seven New Mexico refineries and had sold gasoline to 50 independent jobbers and to more than 200 service stations in New Mexico. These were in direct competition with Conoco outlets in that state, Justice said, so the purchase by Continental would lessen competition.

Conoco's acquisition gave it more than 20% of total gasoline sales in New Mexico and approximately 53% of the refining capacity in that state in 1959, the Justice Department said.

In addition to lessening competition at wholesale and retail levels, the acquisition also eliminated competition between Continental and Malco in the purchase of crude oil, the Government charges. Thus producers in that area now have one less potential buyer.

The move against Continental is an indication that the present administration will continue the emphasis on antimerger action begun by the Eisenhower Administration.

McCollum's comments . . . Continental President L. F. McCollum said in Houston that legal counsel assured the company at the time of the lease transaction 2 years ago that competition would not be lessened.

"Competition has continued to increase, and it has not been lessened by reason of our leasing the Malco refinery," McCollum said.

"We are certain that the Continental-Malco transaction was completely lawful and is not in violation of antitrust laws and will not decrease but tend to increase competition in the growing New Mexico area."

Continental, which is 86 years old, has operated in New Mexico for more than 80 years and has expanded its operations over this long period. But it still controls only about 20% of the gasoline sales in the state.

The Malco refinery at Artesia, N. M., has a 12,000-bbl.-per day capacity. Continental leased it in 1959 for 20 years and holds an option to buy it in 1979.

Shell seeks Oregon permit

SHELL OIL CO. has applied for a permit to do preliminary exploration work in Oregon's tidelands.

Shell's move came within a few days after the Oregon legislature passed a leasing law. The application will be received May 23 when the Oregon Land Board meets. The permit would become effective 90 days after Gov. Mark Hatfield signs the leasing law. He is expected to sign any day.

Under the new law, a preliminary permit such as the one sought by Shell will allow the company to do seismic and geophysical work and to core drill to 500 ft.

If any land is nominated for a lease sale, it would be late summer before a sale could be held. Any drilling probably would be delayed during the winter due to the rough weather in the tidelands.

Area Pricing Trounced, Defended by Lawyers

• Big-company attorneys display sharply different views in panel discussion on FPC's approach to gas-price regulation. Upshot: More proof that industry opinion on the issue ranges from approval to fears of disaster.

MAJOR PRODUCERS are still badly split over the question of whether area gas pricing by the Federal Power Commission will benefit the industry.

During a recent panel discussion in Midland, Tex., on area-price hearings, attorneys for four majors described the concept variously as:

. . . The salvation of the industry.

. . . An evil that will have to be lived with for awhile.

. . . Something that could "gut" the industry if area hearings continue on the current basis.

Lawyers on the panel were: Al C. DeCrane of Texaco Inc., Houston; William J. Merrill, Humble Oil & Refining Co., Houston; H. K. Hudson, Phillips Petroleum Co., Bartlesville; John Thomason, Gulf Oil Corp., Houston; and John M. Davenport, Texas Independent Producers and Royalty Owners Association, Austin.

Their discussion was one of the highlights of an oil and gas legal institute staged May 12-13 by the State Bar of Texas in cooperation with the Midland County Bar Association.

The only answer . . . Merrill argued that area pricing is the only way producers can be relieved of "impossible" regulation, unless measures are passed to exempt them from controls.

He termed FPC's prehearing conference at Midland (OGJ, Mar. 13, p. 84) "a whopping success." And he urged all producers, large and small, to press for more area-price hearings.

View challenged . . . Merrill's views were challenged by DeCrane and Thomason.

Whether such hearings are accomplishing something worthwhile is very much in doubt, both contended.

So far, Thomason said, FPC has declined to give producers more than the vaguest kind of information about its intentions.

He said the price hearings can accomplish something—but only if FPC clears up several points. These points are whether the area price is an absolute price or a guide, whether there will be an escape clause so a producer can justify a price higher than the area price if his situation warrants, and how FPC will handle suspensions of increases.

A dangerous trap? . . . DeCrane expressed similar sentiments. He said area-price hearings, as now conducted, "could gut the industry." It would be better, he said, to call them off and have a nationwide hearing to determine the industry's needs.

Both Thomason and DeCrane were highly critical of Examiner Edward Marsh's report to the FPC on the Midland prehearing conference.

They termed it a mere resume of what went on.

"A necessary evil" . . . Hudson agreed with Merrill that area pricing appears to be the only practical avenue of relief open to producers at present.

No pricing system which disregards the law of supply and demand in pricing gas is going to work well, he said, "but area pricing appears an evil we'll just have to live with for awhile."

Small producers irked . . . Davenport joined the others in voicing displeasure over Marsh's report to the commission.

He said the wording indicates Marsh is recommending that small gas producers be excluded from testifying in upcoming area-price hearings.

Apparently, Davenport said, Marsh bases this move on a conclusion that small operators plan individual rather than joint testimony. Davenport said this conclusion is not true and that TIPRO plans a vigorous protest.

California Wants to Clear Up Boundary Fuss

A PITCH has been made by a California official for settling a title dispute which is tying up leasing off California's coast.

James J. McBride, chairman of two committees in the California Senate, claims the dispute is blocking the development of about 10,000 sq. miles of potential oil land.

McBride says there are at least 4 billion barrels of oil and "tremendous" gas reserves under the disputed area.

The state claims a boundary running 3 nautical miles seaward from the outermost islands off California. The federal Government maintains the boundary is only 3 nautical miles from the mainland and a belt running 3 miles around the islands.

Unlike the Gulf Coast-boundary dispute, no oil has been found in the contested area. The area has never been drilled because of deep water.

McBride appeared before the recent imports hearing in Los Angeles to urge Interior Department officials to call the dispute to the attention of Secretary Stewart L. Udall because of the federal angle.

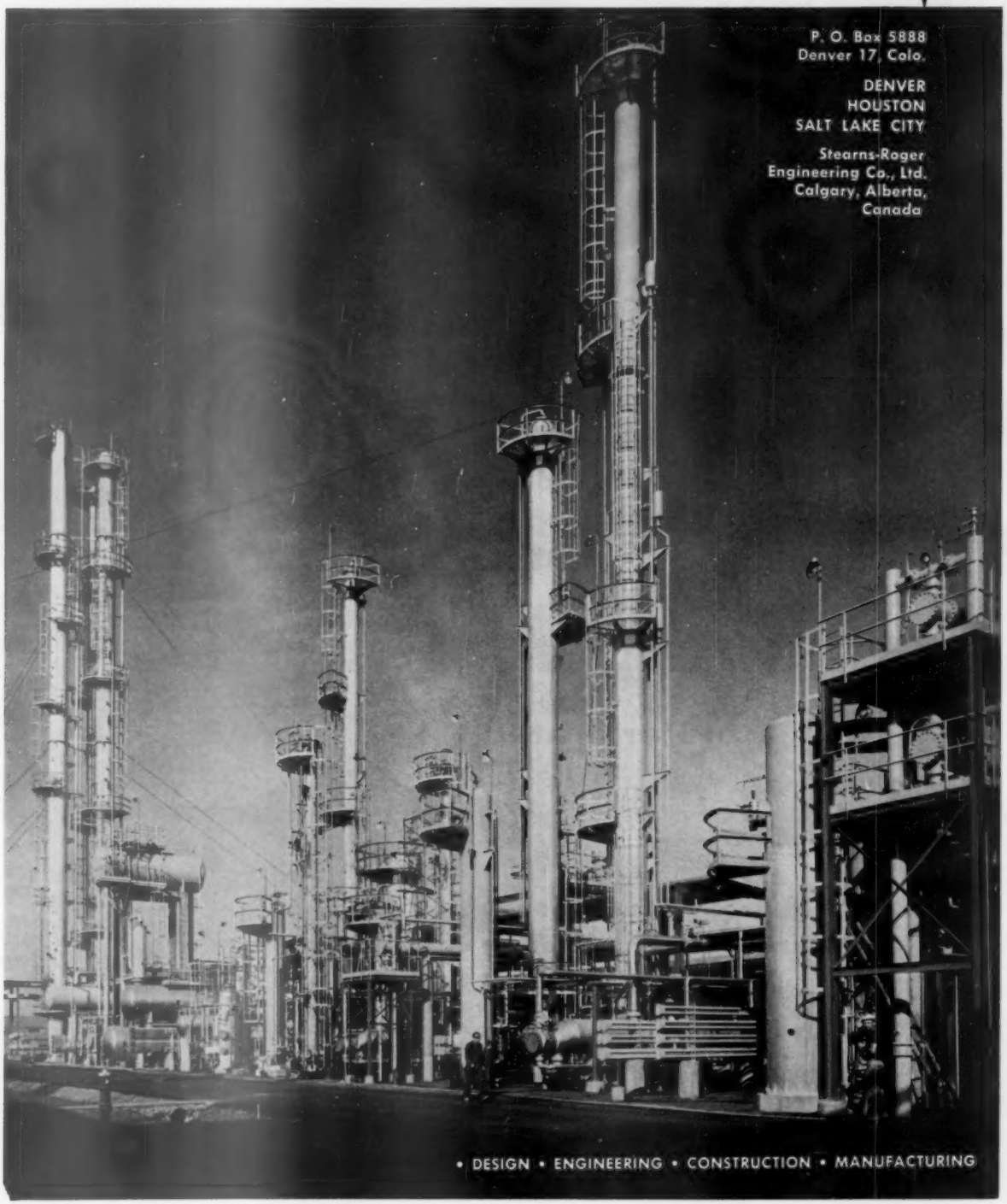
"The existence of this dispute has been considered by all appropriate departments of the State of California, but I have been told by appropriate state officials that we are powerless to do anything about this situation unless the federal Government is willing to initiate the necessary legal action to clarify the title," McBride said.

"No one would suggest litigation of this sort for purely academic reasons. But the time has come when this should be resolved."

PROCESSING---
FROM THE GROUND UP

Our experience dates from the early days of petroleum processing and extends from the Texas Gulf to the Canadian Rockies. Stearns-Roger plants are designed for the raw feed, the products and for economy of investment and operation. Plants engineered and built by Stearns-Roger give customer satisfaction and induce repeat business. Let us engineer and construct your new facility or plant modernization.

Stearns-Roger
THE STEARNS-ROGER MFG. CO. • DENVER, COLORADO



Available now on an industry-wide basis...

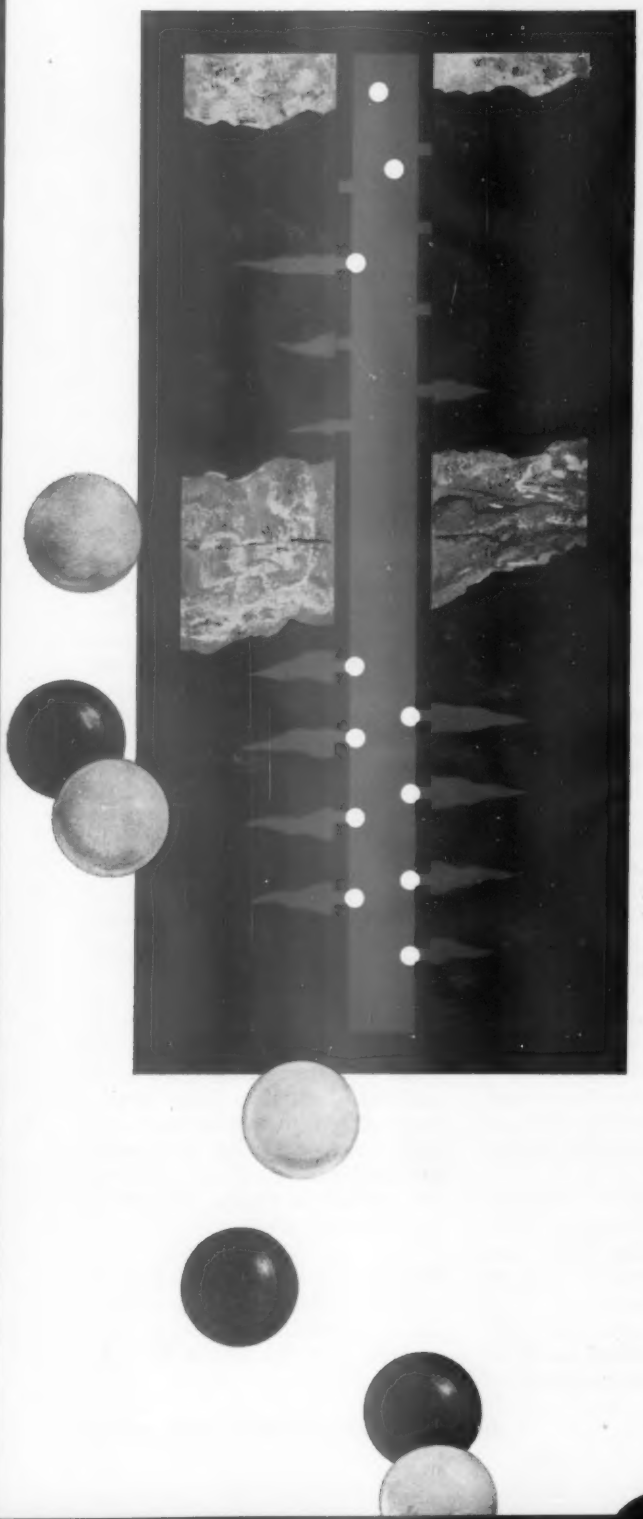
Patented Ball Sealer Process for *One-Stage* Fracturing and Acidizing

of Perforated Pay Zones!

These Ball Sealers help open drainage channels that cannot be penetrated by other methods!

HOW THEY WORK. The Ball Sealers are injected into the fracturing or acidizing fluid at intervals. Reaching the pay zone, the first balls seat on the perforations that are taking the most fluid, diverting the fluid flow to perforations opening on less permeable formations. These formations, in turn, are broken down by the resulting pressure build-up. The process continues until *full* treatment is achieved. When fluid injection stops, the disposable balls—made of nylon, hard rubber or rubber-covered nylon—drop to the bottom of the well.

More effective treating of any zone–regardless of size!



Now the benefits of the patented Ball Sealer process are available to you on an industry-wide basis. Ball Sealers allow *one-stage* treatment of perforated pay zones . . . can save you up to 50 per cent on fracturing and acidizing costs. They can be used with equal effectiveness on multiple sections within a pay zone . . . or on separate production zones in dual completions. Either jet or bullet-perforated casing may be treated—in open casing, down the annulus or through open-end tubing. You're money ahead because Ball Sealers save rig time . . . save multi-stage treatment costs . . . eliminate the cost of bridge plugs and packers. Your service company can give you full details.

Available now through these authorized Service Companies

BJ Service, Inc.
Cardinal Chemical, Inc.
Central Acid Service, Inc.
Halliburton Company
Independent Oil Well Frac Company
Producers Chemical Company
Rig Cementing Co.
Texas Acidizers
The Western Company
West Oil Well Cementing Service

Jobbers Fume Over Pricing Policies

• Ruthless practices by majors are wrecking jobber's chance to stay in business and make a profit, officials of National Oil Jobbers Council declare. Top management in big companies blamed for "cut-throat" pricing.

PRICING POLICIES of the major oil companies have come under bitter attack from the jobber segment of the industry.

Officials of the National Oil Jobbers Council told their members at a Miami Beach meeting that pricing practices of suppliers have become unfair and discriminatory.

This has caused ruinous conditions and a poor public image for the entire industry, the officials charged.

Council President E. K. Bennett, Longview, Tex., jobber, reported he is concerned over the ability of jobbers to make a profit and exist under present conditions.

Bennett declared the blame for cut-throat pricing lies with top management of the oil companies and not solely with marketing executives.

"These people in top management of integrated companies still do not understand that the barrel of crude which they produce and refine does not really represent a profit until the derivatives of that crude have been marketed at a profit," Bennett said.

E. K. Bennett
. . . Realistic pricing needed.

Examples cited . . . The jobber president illustrated his complaint of unfair pricing by three cases in his home town:

One supplier who engages in direct marketing recently delivered a transport load of 8,000 gal. of regular housebrand for 10.85 cents per gallon to a consumer at a time when his dealer tankwagon price was 16.4 cents.

Another company made a price of 14 cents to a small consumer who will buy 1,000 gal. a month.

A third supplier is delivering gasoline to a customer at 14.5 cents per gallon.

"I imagine the dealers of these respective companies would be interested in knowing exactly what the actual value of a gallon of gasoline is," Bennett said. "Chances are they too would like to buy their gasoline at the consumer price."

Bennett declared realistic pricing by major suppliers would do more than anything else to prevent price wars and eliminate discrimination.

His idea of a realistic price: One which enables the jobber to serve the consumer at a reasonable profit as well as serving his dealers on a basis which enables them to be more competitive.

Bennett also pointed out that the drive for gallonage is leading the industry to overbuild service stations and to allow too many obsolete and crossroads stations to stay in existence.

He said these dilute the market and make it harder for more expensive, modern stations to show a profit.

His solution: "Forget about gallons alone and concentrate on making a profit. It does no good to sell a lot of gallons if there is no profit in it."

Government angle raised . . . Bennett warned that management of major oil companies should be aware that a strong, independent jobber-and-dealer segment is one of the greatest deterrents to further government regulation of the oil industry.

"They should be most interested and determined to do whatever is necessary to preserve these bulwarks against further encroachment."

More price trouble . . . Otis H. Ellis, general counsel of NOJC, declared that complaints from jobbers about trade tactics of the majors have reached a new high.

Ellis said the complaints fall into these areas:

. . . Area pricing inaugurated by some suppliers. Ellis said the real objective of these pricing plans, as distinguished from the stated objective, is to increase the major company's net back at the expense of the jobber's gross margin. Oklahoma has been the source of more complaints than any other single area, he added.

. . . National pricing under which a major supplier will grant discounts up to 3 cents per gallon on gasoline purchased from its retail outlets under a national contract. The practice has become more widespread, Ellis said, and the discount rate has grown.

. . . A deal which General Services Administration has made with one major supplier, under which certain government employes are allowed a 4% discount when using this company's credit card. Nebraska and Iowa jobbers are complaining about this. Some dealers have already granted as much as 1 and 2 cents per gallon discount to get this business and the additional 4% creates a terrific competitive problem, Ellis said.

Unfair competition . . . The practice of major companies' taking commercial-account business away from jobbers is getting worse, Ellis declared.

Some majors are now selling gasoline even to small commercial accounts requiring tankwagon delivery at prices up to 2.5 cents per gallon cheaper than a jobber can buy gasoline in the same competitive area.

Jobbers also report that commission agents of companies selling directly to farmers have forced down prices.

In some areas where the normal price for tankwagon deliveries to farmers has been from 1 to 1.5 cents per gallon above the dealer price, majors using direct-selling practices have cut the price to the dealer level or below.

Supplier relations . . . Many jobbers report they have received notices from their suppliers that unless the jobber is willing to sign a new contract calling for lower margins, his present contract will be terminated at the end of the existing period.

The jobbers also are having trouble finding another branded supplier.

Captive residual contracts . . . Ellis reported that one major supplier has nullified the value of new quotas for residual imports received by some of its jobbers.

The supplier has told these jobbers that the next contracts will be made for only a 10-months period to coincide with the allocation period, and they must purchase their quota from the company at its posted price if they expect to get the remainder of their oil needs from the supplier.

But even on this basis, the supplier also has notified the jobbers that there will be a 15% reduction in the volume the company will sell the jobber above the quota.

Ellis declared the NOJC has "warned the Department of Interior and President Kennedy of this type of captive relationship."

Ellis commented that information now shows the major companies are using every conceivable device and pricing scheme possible to improve their net back at the expense of the jobber's margin.

He said if further study proves that jobbers complaints about pricing practices are prevalent throughout the country, he is ready to lead legal and legislative action to combat the trend.

PESA Says Quantity Discounts Illegal

PURCHASERS of oil-field equipment cannot legally obtain discounts by agreeing to do all their buying from one field-supply store.

Efforts by operators to obtain such discounts were disclosed last week by the Petroleum Equipment Suppliers Association in Houston.

The association said its legal counsel interprets the Robinson-Patman Act as prohibiting cumulative quantity discounts.

PESA said invitations for requests for bids or quotations have been circulated recently among supply companies requesting a discount under a purchase agreement whereby the supply store would furnish all the equipment required for 1 year.

"Cumulative quantity discounts are not permissible because a quantity discount can be allowed only on the basis of the seller's being able to justify the difference in price on the basis of an actual difference in cost," PESA said.

Fuel-Oil Men Sore Over Digs

. . . at their industry. Official threatens retaliation in kind if gas, electrical rivals keeping playing rough.

THE TIME may be near for the fuel-oil industry to take off the gloves for some bare-knuckle fighting with its competitors in the energy market.

So says Glenn L. Werly, new president of the National Oil Fuel Institute.

Werly told fuel-oil men attending both the National Oil Jobbers Council and the API Division of Marketing meetings in Miami Beach that their competitors in the gas and electrical industries have resorted to "dirty-pool" tactics in assertions and innuendoes about fuel oil.

He served notice that his organization will start replying in kind unless competitors change their tactics.

In the meantime, Werly reported, NOFI has drafted a four-point program to promote the merits of fuel oil.

The campaign will feature:

. . . Technical work in which a NOFI staff member will make sure that fuel oil gets a fair shake in the specifications, codes, and bids offered by all types of governmental agencies.

Fuel oil has lost markets unfairly and without protest in this area in the past, Werly reported.

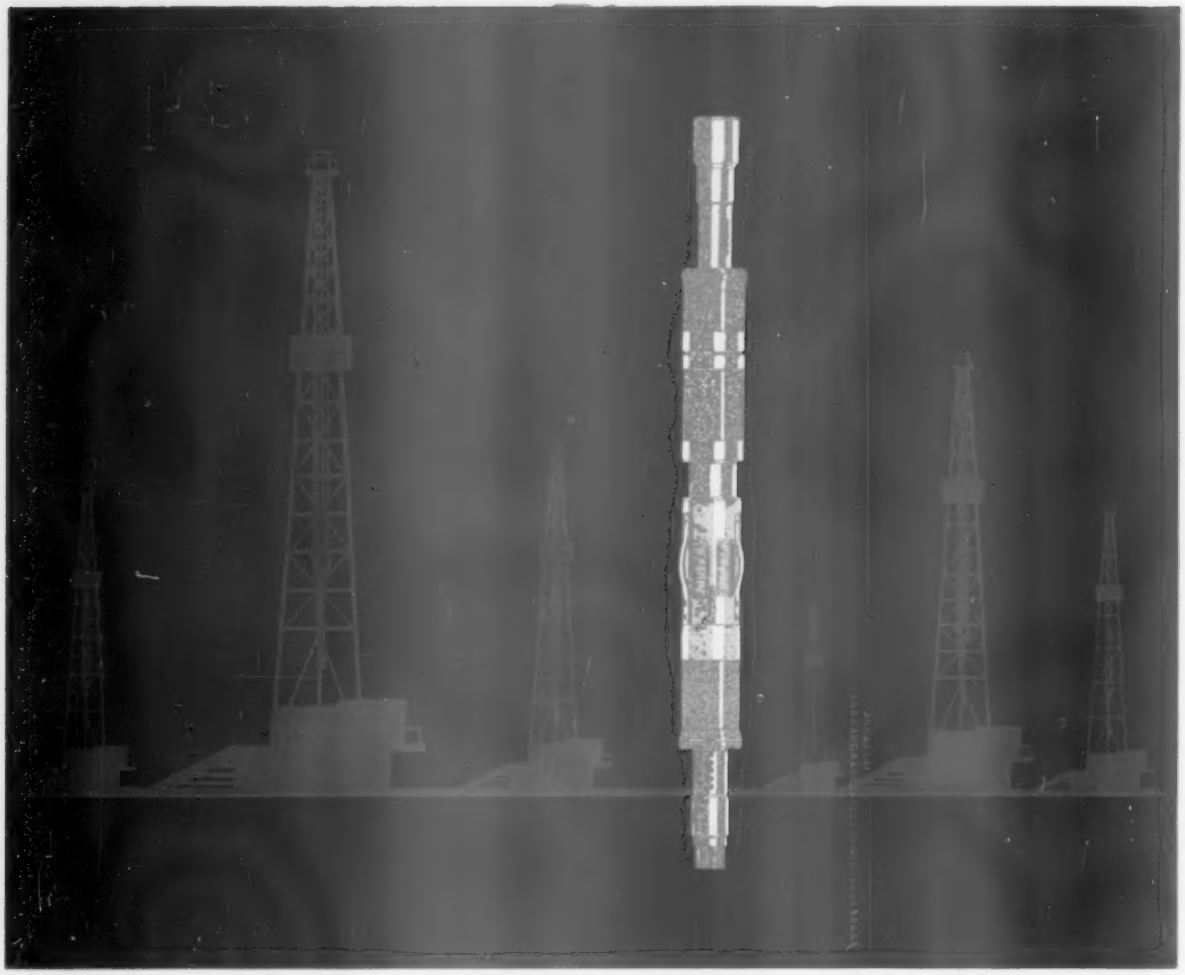
. . . An educational campaign to train technicians in equipment and service and to prepare the industry for the day when gas-fired air conditioning comes on the market in a big way.

Glenn L. Werly

This will give the fuel-oil industry a year-round load and will increase tremendously its requirements for customer service.

. . . A market research staff to provide statistics, map market trends, and make appraisals for industry action.

. . . Advertising on a national basis, going beyond brand names to tell the merits of fuel oil to the consumer and experts who decide on types of fuel and equipment in the building and construction trades.



BROWN DUO-PAK PACKER – KING OF THE OILFIELDS SINCE 1949

Time tested and proved best in thousands of wells, this is the all purpose packer for all producing problems. The cup seals, both above and below the primary sealing element, seal in the casing and on the mandrel and positively prevent leakage from below or above.

Large by-pass ports permit free running, and the packer is set by simply turning five turns to the right and lowering the tubing approximately five feet. A very small amount of tubing weight is required since only the cross-sectional area of the tubing is exposed to upward pressure. After setting the Duo-Pak you can apply pressure either above or below to test the casing or for squeezing, or for production stimulating measures such as acidizing and fracturing.

To pull the packer, no rotation is required – you simply pick up the tubing. This opens the by-pass ports and releases the slips so that the packer can be pulled or relocated.

In addition to being ideal for single and dual completions, stimulation and workover techniques, the Duo-Pak's simplicity of construction makes servicing easy and mechanical failure virtually impossible. In case of stuck pipe or other emergency, the entire packer, except the stem, is readily drillable.

For your next job, remember the Brown Duo-Pak Packer – proven in thousands of wells during the past 12 years. 1. First Packer developed where all working parts are enclosed to prevent corrosion. 2. First Retrievable Packer developed to withstand differential pressure without hydraulic hold-down. 3. First Packer for permanent type well completion – full opening – low tubing load. 4. First Packer to withstand deep swab-down test and still be retrievable.

BOT

BROWN
OIL TOOLS, INC.
8490 KATY ROAD P. O. BOX 19236,
HOUSTON 24, TEXAS

Name Switch Runs Into Work

. . . on a big scale, American Oil finds. Job of changing thousands of service-station signs required 500 crews.

THERE'S a lot in a name, and it's not easy to change one.

At least this is the experience of American Oil Co., currently launching a campaign to establish itself as a national marketer.

The campaign is aimed at telling motorists about the union of three regional petroleum marketers—American, Indiana Standard, and Utah Oil Refining—into a single, nationwide operation.

Another aim is to tell motorists about the switch to American brands of gasoline.

American Super Premium and American Regular are replacing Standard's Gold Crown and Red Crown brands in the Midwest, and Utah Oil's Ultra-Power brands in the Northwest.

In the East and South, however, the company will continue to market its unleaded premium under the Amoco Super Premium brand name as well as American Regular.

The change-of-name campaign is being handled on a national scale with all-media advertising.

A list is impressive: The big national consumer magazines, 800 daily and 1,200 weekly newspapers, 154 television stations, 330 radio stations, 6,400 billboards, and point-of-sale and transportation posters.

As a prelude to the late May advertising campaign, the company changed 16,000 signs at all of its stations in former Amoco and Utah Oil territories.

The Amoco and Utoco identifications were replaced by a torch-and-oval insignia bearing the word "American." Stations and pumps were repainted with new colors and brand designations.

Problems . . . There have been some headaches in the program of going national.

The advertising campaign ran into some regional complications—a legacy from the three-company operations that existed before consolidation.

Advertising men found that art work and copy had to vary from region to region in order to explain how the new company differs from the old ones.

An additional complication: The name "Standard" was retained on signs and station identifications in the Midwest only. This made a split run necessary even in the national magazines.

The sign switch is believed one of the largest of its kind ever attempted. This job was given to Trade Marketers Inc., a specially formed subsidiary of Plasti-Line, one of 14 sign companies manufacturing the red-white-and-blue insignia.

Jack O'Hara, sales director of Plasti-Line, hired 175 contractors who had 500 crews in the field throughout the South and East.

"A job this size," O'Hara said, "had never been done before, so we didn't have any guides to follow. We had to make our own forms, devise our own routing systems, hire and train new employes, and we didn't have any time to waste.

"For example, we had to compile a book of instructions on how the signs should be erected. We had to keep track of progress in each area and receive reports from 32 inspectors who checked the stations after they were changed to make sure the work met American Oil's specifications."

SWITCHING OF SIGNS in 16,000 stations in the South and East marks the emergence of American as national marketer.

Gulf Adds Petrochemical Facilities

GULF OIL Corp. last week dedicated one new petrochemical plant at its Philadelphia refinery and broke ground for a new benzene-cumene complex.

Although the process will not be used there at this time, development of a thermal process for converting toluene to benzene also was announced.

Benzene feed stocks for the new cumene plant will be obtained by solvent extraction of catalytic reforming streams.

The plant officially dedicated was the new 35-million-pound-per-year oxo-alcohol unit. Similar to the plant built at Port Arthur, Tex., in 1953, the new plant incorporates knowhow gathered from operation of that plant.

Bulk of the Philadelphia plant's output will go to Europe.

"THD" is the name Gulf has applied to its new thermal hydrodealkylation process. It was developed by Gulf Research & Development Co.

Pilot-plant studies have shown that 93 to 97% yields (theoretical) of benzene can be obtained from toluene feed stock.

Operating conditions were not revealed except to the effect that moderate pressures and high reactor temperatures are required.

The process also can be used for producing naphthalene from petroleum fractions and coal tar.

Negotiations are currently under way to build two plants using the THD process, Gulf announced. HDA, developed by Atlantic Refining Co. and Hydrocarbon Research, Inc., is a similar thermal process (OGJ, Mar. 6, p. 80).

Canadian Crude Line to U. S. Planned

INTERPROVINCIAL Pipe Line Co. has applied to the National Energy Board of Canada for permission to build a 90-mile spur from its crude line at Hamilton, Ont., to Buffalo, N. Y.

The line would deliver Alberta crude to the 30,000-bbl. refinery of Ashland Oil & Refining Co. and perhaps later to Mobil Oil Co.'s 31,000-bbl. plant.

Ashland started this month taking 8,000 bbl. daily of Alberta crude by barge from an Interprovincial terminal. This volume is expected to build, and Mobil also is expected to supplement its present U. S. supply from Canadian sources.

The Interprovincial project is contingent upon the favorable outcome of the current import studies in Washington. Imports control officials have expressed concern at the level of imports from Canada into the U. S. Great Lakes area in recent months.

Wilderness Bill Attacked

. . . by API's Gage Lund. Proposed measure would prohibit oil work in 50 million acres spread through 11 states.

AN American Petroleum Institute official is speaking out strongly against the proposed wilderness bill.

Gage Lund, API vice president of production, runs the risk of some people thinking his stand is "like attacking motherhood and the flag." But he says he is not against preserving wildlife nor conserving the wilderness.

He does oppose the legislation which is proposed.

Speaking at the API Division of Production's Pacific Coast district meeting in Los Angeles, Lund said he favors multiple use of wilderness areas. This pattern has been established in the U. S. and has proved workable, he said.

The National Wilderness System, which would be set up if the proposed legislation passes, would ban oil and other commercial activity in more than 50 million acres in 11 western states.

"These are lands of unknown potential, barely prospected for minerals or not at all," Lund said. "A number of them have geological structures that are favorable to oil production. But we'll never know what they hold unless we get a chance to go in and find out."

The measure is being studied by committees in both houses of Congress. It has gained wide support from conservation groups. Limited opposition has been voiced primarily by representatives of the states affected by the withdrawals.

Worked in Alaska . . . Lund, a vice president of Standard Oil Co. of California, points to his company's experience in the Kenai Moose Range of Alaska as an example of how a successful wildcat and development program can be carried on in a wildlife preserve.

The Kenai oil boom would never have been possible under terms of the proposed legislation, Lund said. Part of the moose range is still off limits to oil operations, but is "very promising geologically."

Lund says he feels the moose have prospered as a result of the oil play on the Kenai.

"They feed on the tender second growth of the brush and timber we cut in preparing sites, and they use our plowed roads to get around in the winter rather than buck the snow in the open fields."

Too, the oil operation has taken only a small part of the surface rights in the 2-million-acre range. On 160-acre spacing it would take only 4,400 acres to develop the 1,443,000 acres that look like possible oil country. And even on 80-acre spacing something less than 10,000 acres would be needed. This is less than one half of 1% of the preserve.

The API official suggested a study being made by the Outdoor Recreation Resources Review Commission be completed before any new wilderness laws are passed. This study will be completed next year. If this study shows legislation is needed, Lund says the laws should be passed. But any legislation should be based on providing the "greatest good for the greatest number."

Sale of Offshore Gas Reserves to TGT Nears Finish

THE SALE of $97.3 million worth of offshore Louisiana gas reserves by the Catco group to Tennessee Gas Transmission Co. has been completed except for approval of the deal by the Interior Department.

Confirmation of a conditional closing of the transaction for 533 billion cubic feet of gas in the Ship Shoal area. Block 176 field, came from TGT.

The reserves are in federal waters.

An industry spokesman indicated that Catco (Continental, Atlantic, Tidewater, Cities Service) has reached agreement with the Internal Revenue Service on tax aspects of the huge sale of reserves (OGJ, Mar. 27, p. 62).

PROCESSING

A 15-million-pound paraxylene unit will be built at Suntide Refining Co.'s Corpus Christi refinery. Contract has been let to Ralph M. Parsons Co. Completion is scheduled for January. Output will be sold under long-term contract in Europe. Suntide now has under construction a 60-million-pound styrene unit and a 30-million-pound ethylbenzene unit.

Cyclohexane facilities are planned for British American's Clarkson, Ont., refinery. Construction of the 15 million gallons per year unit will get under way early in 1962 with completion expected in the fall of the same year. Also under consideration are plans to make more benzene, the raw material for cyclohexane, from feed stocks produced

U. S. Producers to Fill New Energy Demands

• Forecast says domestic oil and gas industries will get mission of supplying biggest share of expected 26% increase in fuel needs during this decade.

DOMESTIC oil and gas producers will be called on during this decade to meet most of a projected 26% increase in the nation's demand for energy.

Prime factors in demand will be a 19% gain in U. S. population to 214,000,000 by 1970 and a continuing rise in per-capita consumption.

These conclusions highlight a study of the future growth of the domestic petroleum industry just completed by E. E. Monteith, Jr., vice president of the Republic National Bank of Dallas, and K. L. Boren, petroleum engineer for the bank.

Monteith and Boren make these predictions:

... **Gas will shoot** from a current production of 35.5 billion cubic feet daily to 50.6 billion cubic feet daily in 1970. At this level, gas will be meeting 34% of total U. S. energy requirements compared with only 18% in 1950 and 28% in 1960.

... **Crude output will climb** to 8,100,000 bbl. daily in 1970 compared with the current rate of 7,030,000 bbl. daily. Crude's share of the energy market, however, will continue to decline. From a peak of 42% in 1958, its share will fall to about 38% by 1970.

... **Gas liquids will soar** to a production of about 1,670,000 bbl. daily in 1970 compared with the current 1,130,000 bbl. daily. The advance will be made at the expense of crude.

... **Drilling will fall off** from last year's 46,800 wells to only 39,800 in 1970.

... **Oil reserves will stabilize** at about 33 billion barrels by 1970.

... **Gas reserves will mount** about 2.5% yearly despite the heavy production gains, and will reach 350 trillion cubic feet by 1970. But in terms of years' supply, reserves will drop to 19 years in 1970 compared with about 21 years in 1960.

Imports must be held ... The study assumes that imports will be held by government control at the 1960 rate of about 18.4% of total liquid-hydrocarbon supply.

At this level, imports in 1970 would run about 2,200,000 bbl. daily. Domestic crude and natural-gas liquids would make up about 67.6% and 14%, respectively, of total liquids supply.

Any increase in oil imports over this 18.4% rate would "be disastrous to the domestic oil industry."

Heavy wildcatting seen ... Monteith and Boren say important factors in the reduced-drilling rate of 1970 will be wider spacing, deeper wells, multiple completions, and other technological strides.

While total drilling will be off, they add, wildcatting will remain active with about 13,000 tests a year during the decade.

Reserves picture ... Leveling off of crude reserves at about 33 billion barrels by 1970 will mean a decline in years' supply of crude to 11 years by 1970, in the opinion of Monteith and Boren.

At expected production rates, reserves added per well would have to increase from the current 70,000 bbl. to about 100,000 bbl. in 1965 and to 117,000 bbl. in 1970 to maintain a reserve-production ratio of 12.

BRIEFS ...

at both the Clarkson and Montreal refineries.

A dual-purpose resin unit will be built by Du Pont at its Orange, Tex., plant. The new unit will produce a copolymer of ethylene and vinyl acetate, and increase high-pressure polyethylene capacity.

A Hydeal unit is on stream at Suntide Refining Co.'s Corpus Christi refinery producing 750 bbl. per stream day of benzene from toluene.

A new smog-control catalyst has been developed by W. R. Grace & Co. The company expects to apply soon to California authorities for testing the new product on auto exhaust purification.

The Polymer Chemicals Division of W. R. Grace & Co. will cooperate with Chemore Corp. in marketing polypropylene produced at the new plant being built at Neal, W. Va., by Novamont Corp. Both Chemore and Novamont are subsidiaries of Montecatini of Milan, Italy.

Alkyl lead manufacturing facilities are to be built at Freeport, Tex., by Nalco Chemical Co. Fluor Corp. will handle design and engineering work for the plant that will produce 40 million pounds of tetraethyl lead or 34 million pounds of tetramethyl lead per year.

A maleic anhydride plant, first on the West Coast, has been put on stream by California Chemical Co. at Richmond, Calif. The new unit will produce 20 million pounds per year of maleic anhydride by air oxidation of benzene.

Also for Refiners ...

IN THE NEWS: Aromatics outlook indicates there will be a surplus, but not a glut (p. 39) ... Gulf is expanding its petrochemical facilities and has announced a new thermal hydrodealkylation process (p. 57) ... Boom is predicted for petrochemical production in Permian basin (p. 44) ... Justice Department is challenging Conoco's lease of Malco Refineries (p. 49).

PLUS JOURNAL SURVEY of petrochemical construction in U. S. and Canada (p. 66).

A Look at April Crude Runs to Stills . . . as reported to the Texas Railroad Commission May 18.

Company—	Avg. in bbl. daily	% of capacity
Am. Petrofina	22,345	74.5
Atlantic Ref.	187,271	89.2
Bell	6,341	79.3
Bryson Pipe Line	473	43.0
Cities Service	252,726	86.3
Continental	165,280	85.5
Cosden	36,497	84.9
Crown Central	31,521	78.8
Danaho Refining	3,488	29.0
El Paso Natural	23,448	106.6
Gulf	466,520	82.8
Humble	801,000	83.3
Indiana Oil	570,000	79.2
LaGloria	17,438	72.7
Monarch	2,779	69.0
Ohio	81,000	73.4
Permian	2,379	59.5
Phillips	213,100	77.7
Plymouth	35,366	78.6
Premier	16,151	72.0
Pure	166,122	88.8
Shamrock	17,386	64.4
Shell	495,598	83.4
Signal	53,814	89.6
Sinclair	395,230	80.8
Skelly	51,001	94.0
Socony Mobil	533,000	74.4
Sohio	123,356	72.3
Standard (Tex.)	49,753	66.3
Sun	206,821	81.1
Suntide	33,368	51.3
Texaco	639,367	86.5
Tidewater	241,633	87.9
Wickett	1,289	37.0
Others	1,522	60.9
Total	5,944,383	
March total	6,123,967	

It's 8 Days for Texas in June

CRUDE buyers spoke to the Texas Railroad Commission last week with almost a single voice.

No one wanted more than 8 producing days in June. Only two small companies wanted 7 days. The rest, without a dissent, asked for 8.

The new 8-day allowable set by the commission authorizes a production of 2,702,699 bbl. daily. This is up 66,137 bbl. from the initial May allowable and up 52,507 bbl. from the allowable in effect on May 6.

New FPC Nominees About to Be Seated

ALMOST 4 months after their appointments were announced, Joseph C. Swidler and Howard Morgan are on the verge of being seated on the Federal Power Commission.

Swidler is a Nashville attorney who served for almost 25 years with the Tennessee Valley Authority. Morgan is a politically active Oregon rancher who served for 2 years as utility commissioner in his state (OGJ, Feb. 6, p. 80).

The Senate Commerce Committee last week approved—with some dissenting voices—the nomination of Morgan. It had approved the Swidler appointment a few days earlier.

The remaining step was a Senate floor vote on the nominations. Action on Swidler was expected momentarily, but some delay still loomed for Morgan because the split in the committee resulted in the preparation of majority and minority reports to go before the full Senate.

Some committee members were opposing Morgan because they felt he had deliberately covered up two brushes he had with the law many years ago.

It appeared likely there would be some floor debate over Morgan, but observers felt that he would eventually be cleared.

When Swidler and Morgan are seated, it will bring the commission to its full five-man strength for the first time in more than a year.

This status may be shortlived, however, since the term of Commissioner Arthur Kline expires June 25 and no successor has been named.

Because Swidler and Morgan are Democrats, the replacement of Kline by a Democrat would give the administration majority control of the commission.

The "new look" at the FPC will begin to shape up after Swidler and Morgan are seated.

This may result in some marked changes in the commission's stand on various gas-regulatory issues.

Honolulu Sale Deal Closed

SALES agreements which call for two companies to pay $380 million for Honolulu Oil Corp. were signed in Jersey City, N. J., last week.

Pan American Petroleum Corp. and Tidewater Oil Co. signed the agreements on the day their joint bid and several other bids for Honolulu expired.

The two companies are paying approximately $100 a share for the San Francisco-based company. Part of the deal will be a cash payment and part will be handled by 10 corporations which are taking over production payments.

Tidewater is buying Honolulu's California assets, which include 555 oil and gas wells, and half interest in the company's Alaskan leases.

Pan American is getting the remainder of the holdings. These include 1,095 wells in West Texas, New Mexico, Wyoming, and Canada.

The sale is subject to approval by Honolulu stockholders.

PIPELINE

Gas line from Kansas' Spivey-Grabs-Basil field to Skelly's big El Dorado, Kans., refinery, has been proposed by Anadarko Production Co., a subsidiary of Panhandle Eastern Pipe Line. The 10 and 12-in. line would run 83 miles. Construction application has been filed with the Kansas Corporation Commission.

United Gas Pipe Line's plan to connect Bastian Bay reserves with its existing system hinges on Gulf and Tidewater's acceptance of an initial gas sale price of 23.23 cents per M.c.f. The producers had originally sought a price of 24.8 cents per M.c.f. FPC has granted temporary approval to the United Gas expansion. It will become perma-

Big Finds Made on Texas, Louisiana Coasts

TWO BIG discoveries highlight last week's activity on the Texas-Louisiana Gulf Coast.

A major gas-condensate discovery in Matagorda County, Texas, was announced by Tenneco Oil Co., subsidiary of Tennessee Gas Transmission Co.

Forest Oil Corp. brought in a dual gas discovery on an offshore Louisiana tract next to a cluster of tracts that were sold in a federal lease deal early last year.

In announcing completion of the M. L. Davis Gas unit 1, Tenneco said drill-stem tests indicate 250 ft. of net pay in seven separate gas-condensate reservoirs between 10,790 ft. and 12,214 ft. All seven reservoirs are in the Frio sand.

Forest Oil's discovery well was completed at depths of 11,000 ft. and 12,000 ft. The shallower sand flowed 2,500,000 cu. ft. of gas daily through a 10/64-in. choke, and flowing tubing pressure was 4,500 psi. The deeper sand flowed 4,400,000 cu. ft. through a 12/64-in. choke, and pressure was 5,850 ft.

Tenneco well . . . The Tenneco well has been singly completed through perforations at 12,090 to 12,120 ft.

This zone flows 3,655,000 cu. ft. of gas daily, with 267 bbl. of condensate per million cubic feet, on an adjustable choke.

Wellhead pressure was 5,485 lb., calculated bottom-hole shut-in pressure was 8,477 lb., and calculated absolute open flow was 24,000,000 cu. ft. daily.

The discovery is in the W. G. Davis Survey, A-567, 7 miles southwest of Blessing and 1 mile south of the new Trull field which Tenneco brought in last fall.

Forest well . . . The tract in which Forest made its discovery comprises Block 129, Vermilion area, 30 miles offshore and 6 miles from the nearest production.

Forest's tract went for only $540,800 in a lease sale.

Forest is operator for a three-company combine which bought Block 129. Others in the venture are Amerada Petroleum Corp. and Texas Gas Corp.

Grain Ship to Drill in Lake Erie

THE OIL industry soon will use its first converted grain ship for offshore drilling purposes. The drilling location: Lake Erie.

Offshore Co., contract driller, is having the 3,000-ton deepwater grain carrier, SS Simcoe, converted into a floating drilling barge at a Lake Erie shipyard. It will go to work shortly for El Paso Natural Gas Products, which holds a drilling permit in the Canadian waters of Lake Erie.

The vessel, renamed the Offshore C-1, will be able to drill in water depths to 210 ft., the maximum in Lake Erie.

The barge will be towed to position in the lake and stabilized with anchors and winches. Its propeller will have been removed.

It will have a drilling slot 15 ft. wide cut through the center.

Offshore Co. last week shipped by rail from Baton Rouge several pieces of equipment, including a 96-ft. derrick, two 15-ton diesel cranes, four air compressors, and a National T-20 draw works powered by one twin 671 diesel engine.

The barge itself is 252 ft. long and 46 ft. wide and has a draft of 15 to 16 ft.

Offshore Co., which will operate in Canada through its subsidiary, Northern Offshore Drilling, Ltd., owns the largest fleet of mobile drilling barges in the world.

BRIEFS . . .

nent if the producers accept the lower price. United would build 59 miles of 30-in. line from Bastian Bay to Lirette, La., at a cost of $17 million.

First section of the Glacier Pipe Line system, a 50-mile, 6-in. line to serve the Stensval area of eastern Rosebud and western Musselshell counties in Montana, has been finished. Work is under way on other sections of the system, which will carry crude from Cut Bank, Mont., to Byron, Wyo., where it will connect with eastbound systems.

Construction of 34.7 miles of 8⅝-in. line to supply Southern Union Gas of Dallas is planned by El Paso Natural Gas. Southern Union would resell 20,000 M.c.f. of gas daily to Southwest Forest Industries in Navajo County, Arizona, for pulp-mill fuel. El Paso Natural Gas has asked FPC to approve the project.

Permission to build 33.1 miles of pipelines to onshore and offshore Louisiana fields has been granted by FPC to Tennessee Gas Transmission. Lines will serve Lac Blanc field in Vermilion Parish and offshore fields of West Cameron, Block 68, and Grand Isle, Block 47. TGT will pick up 382.5 billion cubic feet of natural gas.

A natural-gas and condensate system made up of 26.5 miles of new line and 14.7 miles of existing line is proposed by Royalite Corp. to make deliveries from the Wildcat Hills and Jumping Pound fields to Calgary. Products would be moved to Imperial Oil's Calgary refinery at 21 cents per barrel in the case of Jumping Pound and 22 cents a barrel in the case of Wildcat Hills.

Northern Gas has a request before the Wyoming Public Service Commission to construct a 24-mile 6-in. gas line from the O'Brien Springs field in Carbon County to its main line near Sinclair, Wyo., at an estimated cost of $245,000.

Testing of Panhandle Eastern's Waverly storage field in Morgan and Sangamon counties of Illinois has been approved by an FPC examiner. Preliminary testing was carried out from 1952 to 1958. The second stage involves injecting 6 billion cubic feet of gas into the St. Peter formation and determining the effectiveness of the St. Peter seal.

Soviet's Cheap Oil Gains Markets in Japan

• Signs point to a Russian trade offensive aimed at corraling more of the mushrooming Japanese market. Middle East oil will feel the squeeze. Japan has depended on that area for more than 80% of its crude in the past.

RUSSIAN oil is beginning to crowd Middle East oil in one of the free world's fastest expanding oil markets—Japan.

The Middle East has traditionally supplied more than 80% of the Japanese crude market. The Russians are moving in fast. There is every indication they plan to carve themselves an increasingly bigger slice of the Japanese market and they are doing it in just one way—selling their oil cheap.

The first big jump in Russian oil shipments to Japan came last year when the Soviets moved 7.8 million barrels of crude into the Japanese market. This is about 21,370 bbl. daily and represents about 4% of total Japanese oil imports. In addition, the Russians sold the Japanese almost 3,000 bbl. daily of fuel oil.

In the first quarter of this year, the Russians shipped 3,180,000 bbl. of Iron Curtain crude to Japan, or about 35,300 bbl. daily.

These figures contrast with 1959 Russian sales in Japan of only 610,000 bbl. (about 1,900 bbl. daily) of crude and only 230,000 bbl. (630 bbl. daily) of fuel oil. The 1959 crude shipments amounted to only 0.5% of total Japanese imports.

How it's being done . . . The cost-conscious independent Japanese refiners, shackled by government-imposed foreign-exchange curbs, have been looking on cheap Russian oil with more favor all the time. But interest really began to pick up recently when the top Red oil salesman, E. P. Gourov, visited Japan.

Gourov, fast-moving head of Sojuznefteexport, talked quantity and price with the government, Idemitsu Kosan, Toa Oil, and others.

The most intriguing report of Gourov's visit concerns his negotiations with Kinoshita Trading Co. Nothing official was revealed about the talks. But widespread reports in the Japanese oil industry are that Gourov wants to trade 63,000,000 bbl. of Russian crude for $150 million worth of line pipe which the Japanese can manufacture and which Russia needs badly.

Such a swap would place a much higher value on the Russian crude than the Japanese would have to pay in an outright purchase.

The pipe might be used by the Russians on their proposed Trans-Siberian pipeline to the Pacific Coast near Vladivostok. If and when this line is completed, the Russians would like to really plunge into the Japanese crude market.

The 28.5-in. Russian line planned to extend to the Sea of Japan has already been built from the big Second Baku oil area to Irkutsk in Central Siberia (OGJ, March 27, p. 76).

The real secret to the Russian success in Japan is price and the Japanese foreign exchange allocation.

The Russians give the Japanese an f.o.b. price about 60 cents a barrel cheaper than Middle East oil. The laid down cost of Russian oil has a slimmer margin than this, but the f.o.b. price is what is important to the Japanese refiner using his government's foreign exchange allocation.

The Russians quote the Japanese f.o.b. prices ranging from 80 cents to $1.10 a barrel, compared to the average Middle East f.o.b. price of $1.50. There is a much smaller margin of only about 30 cents a barrel between laid down costs of the two crudes.

The vital thing is that a Japanese refiner, using the lower f.o.b. cost of Russian crude, can bring in a larger amount of crude with a given exchange allocation and at the same time qualify for an even larger allocation in the future (OGJ, July 25, 1960, p. 141).

Another significant deal being talked in Tokyo concerns Russian plans to supply at least a part of its communist Chinese partner's product demand with Japanese-refined Russian crude.

Tokyo reports indicate Kawakami

How Russians Cut Prices

F.O.B. Prices of Japanese Crude Imports in 1960
(Dollars per Bbl.)

	Industry Average*	Russian Importers		
		Idemitsu	Shin Asia	Taiyo
January	$1.65	$1.52	$1.64	$1.38
March	1.62	1.50	1.59	1.53
May	1.60	1.51	1.56	1.34
July	1.59	1.44	1.36	
September	1.51	1.39	1.39	1.41
November	1.47	1.29	1.36	1.34

*80% of all imports are from the Middle East.

Trading Co. and a communist Chinese trading company are negotiating a deal whereby Idemitsu Kosan would process Russian crude and products would be exported to the Chinese mainland for the first time since World War II.

Who's buying Russian oil . . . Soviet oil shipments to Japan date back to 1958 when the first Russo-Japanese trade agreement was signed. That year Taiyo Oil, a small independent refiner, imported 82,000 bbl. of Sakhalin crude.

The following year the volume of both Sakhalin and Second Baku crude jumped to 610,000 bbl. with independents like Idemitsu Kosan, Toa Oil, and Taiyo Oil taking the oil under the terms of a second trade agreement.

In January 1960 Taiyo Oil signed a 3-year Russian agreement to import 4,000 bbl. daily and Shin Asia Oil made a 6-year pact with the Soviets calling for 5,000 bbl. daily. Three months later Idemitsu Kosan inked an agreement calling for the Russians to ship from 20,000 bbl. daily to 26,000 bbl. daily over a 6-year period.

These individual contracts quite obviously exceed the formal 3-year trade agreement signed last March by the Russian and Japanese governments. This trade pact provides for crude and fuel oil shipments of 22,000 bbl. daily the first year; 28,000 bbl. daily the second year; and 35,000 bbl. daily the third year.

El Agreb Production Moving

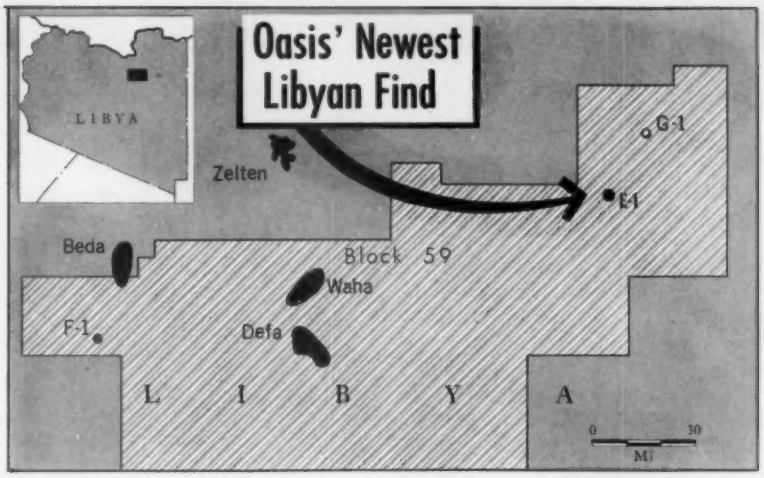
FIRST PRODUCTION from a new field in the southern Sahara was on its way to the Algerian Mediterranean coast last week.

The first commercial delivery of El Agreb oil at Bougie is expected within a week.

Production from four wells at El Agreb and one at El Gassi is being moved north through a new 10-in. pipeline about 25 miles to the Haoud el Hamra terminal which serves the big Hassi Messaoud field.

Soc. Nationale des Petroles d'Aquitaine, operator of the new field, is moving about 10,000 bbl. daily through its feeder to the big 24-in. pipeline system.

Recently SNPA completed the fifth El Agreb producer in a 230-ft. pay found at 10,145 ft.



Oasis Scores Again in Libya

OASIS Oil Co., already one of the most successful oil finders in Libya, has done it again.

The company's big Block 59 which already has two productive oil fields, has come up with a well that could rival anything yet found by the company.

The newest well, E-1, has tested at the rate of 1,500 bbl. daily of 37°-gravity crude from 200 gross feet of productive limestone topped at 2,704 ft.

The well, 90 miles east of Oasis discoveries at Waha and Defa, is only about 150 miles south of the Mediterranean coast. The wildcat is being deepened and last week was having lost-circulation trouble below 3,200 ft.

Location for a new test, G-1, has been spotted 6 miles north.

French Developing New Sahara Field

THE FRENCH are so encouraged by stepout drilling at the newest southeastern Sahara discovery that they are moving in a second rig to develop Tin Fouye.

Cie. de Recherches et d'Exploitation de Petrole au Sahara (CREPS) has completed as producers two of three wells drilled since the discovery.

The latest well, Tin Fouye 4, tested from 1,200 bbl. daily to almost 1,700 bbl. daily from a Devonian sandstone found between 4,165 and 4,251 ft.

The new field is 48 miles east-northeast of Fort Flatters and 100 miles west of Ohanet. It is near the route of a new 30-in. pipeline, now under construction, which will link Ohanet — and eventually Edjele — with the big Hassi Messaoud field.

Discoveries Brighten Gabon Oil Scene

TWO NEW discoveries, one a rank wildcat and the other on a new structure in an established producing area, have brightened Gabon's oil picture.

Soc. des Petroles d'Afrique Equatoriale (SPAFE) tested 25 bbl. an hour of 33°-crude from a 59-ft. Lower Tertiary sandstone topped at 3,410 ft. at Simany 1.

The well was drilled on a new structure near Port Gentil, an established producing region.

The rank wildcat, Pointe Weze 1, is being tested in an area held jointly by SPAFE and Mobil International. Located about 3.5 miles south of N'tombenyoni, the well flowed 20 bbl. in a 40-minute test of a 56-ft. section topped at 3,962 ft.

The well is still being tested.

Libyan Pipeline Project Clears Last Hurdle

- **Contract let for big Sidrah system after battle with red tape.**

A CONTRACT for building Libya's second 30-in. pipeline system has been awarded after months of dickering with local and national Libyan officials to get the job under way.

The new big-diameter line will be called the Sidrah pipeline system. It will link Dahra and Mabruk fields to a deepwater terminal at Es Sider on the Gulf of Sirte and will be built by Libyan Engineering & Construction Co. and Arabian Bechtel Corp.

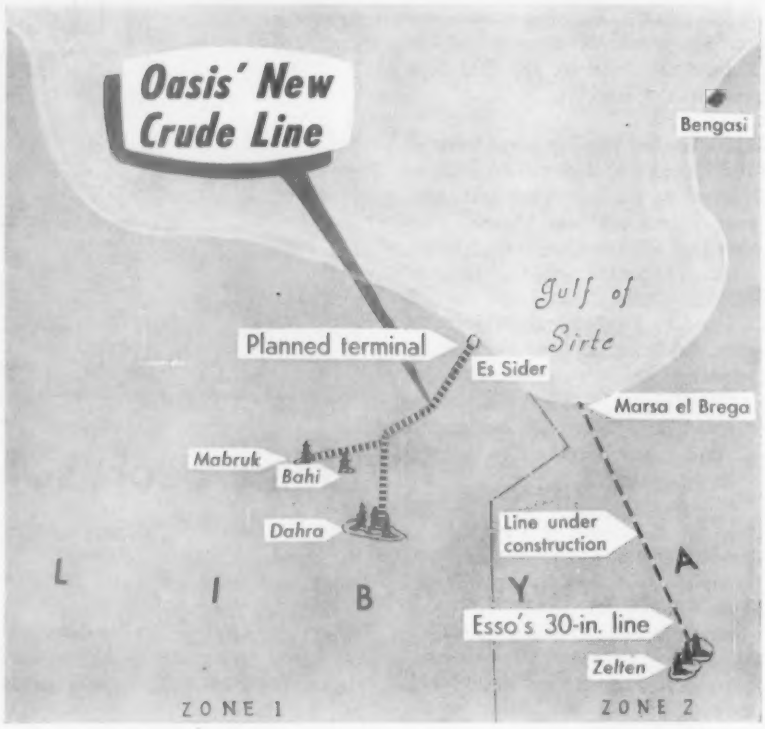
The Bechtel firm also is building a 30-in. line from Esso Libya's Zelten field to a Mediterranean terminal.

The new pipeline system will be owned by six companies. It will be supervised and operated by Oasis Oil Co. which is developing Dahra field.

Oasis is jointly owned by Continental, Ohio, and Amerada.

The other three companies involved in this project are Esso Sirte, Libyan American Oil Co., and W. R. Grace & Co. These three own Mabruk field.

Trunk line of the new system will be 90 miles of 30-in. A connecting line of 39 miles will run from Mabruk to the main system at a point about 50 miles south of the terminal on the Gulf of Sirte.



The contract awarded last week also provides for gathering systems in the fields, communications and control systems, seven 3,000,000-bbl. storage tanks at the terminal site, and harbor equipment.

Oasis now has 41 oil and gas wells at Dahra. Esso Sirte, which took Mabruk over on a farmout with Libyan American and Grace, has eight producers in its field.

Oasis says it expects the new pipeline system to be completed and in operation before July 1 of next year.

Arabia Adds Big Oil Reserves

A REPORT says Saudi Arabia added more than 7 billion barrels to its proved recoverable oil reserves last year by drilling only 17 wells.

The sharp jump in the country's official reserve figure was revealed by Arabian American Oil Co. in its annual report to King Saud.

Other highlights of the report:

Daily average production for 1960 totaled 1,247,140 bbl., an increase of 13.9% over the previous year. Present production is well above the 1.4-million mark.

Refinery runs averaged 224,894 bbl. daily, an increase of 29.4% over 1959.

Proved reserves in Aramco's concession area are estimated at 45.6 billion barrels. Aramco pointed out that its 1960 drilling program added new reserves which exceeded the year's production by 7 billion barrels.

Safaniya field, off the coast of Saudi Arabia in the Persian Gulf, is now called the largest offshore oil field in the world by Aramco.

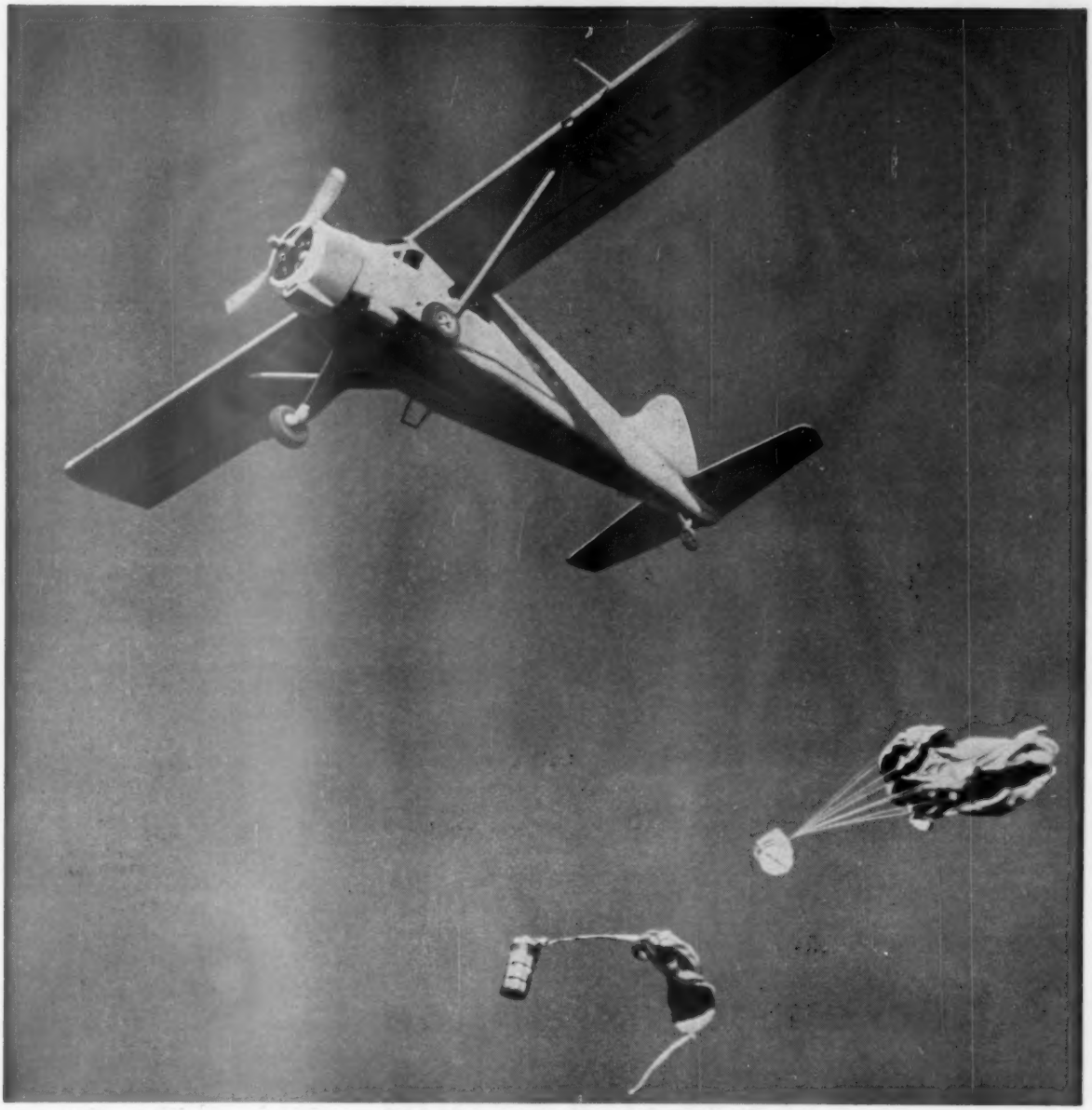
Four new wells drilled at Safaniya last year more than doubled the known size of the field. The field produced an average of 181,000 bbl. daily last year from 20 wells. It has another 15 wells shut in.

The first refrigerated liquefied-petroleum-gas plant in the Middle East was built at Ras Tanura to produce about 3,000 bbl. daily of LPG for export.

Another LPG plant at Abqaiq is being built at a cost of $8 million.

Acreage turned back . . . The report to the King revealed for the first time that Aramco has turned back another 33,700 sq. miles of its concession area to the government.

This is the fifth such move under terms of the company's 1948 agreement with the Saudi Government. Aramco has given up a total of 140,413 sq. miles in its exclusive concession and another 135,200 sq. miles in a part of the country where the company has preferential rights to any concession granted.



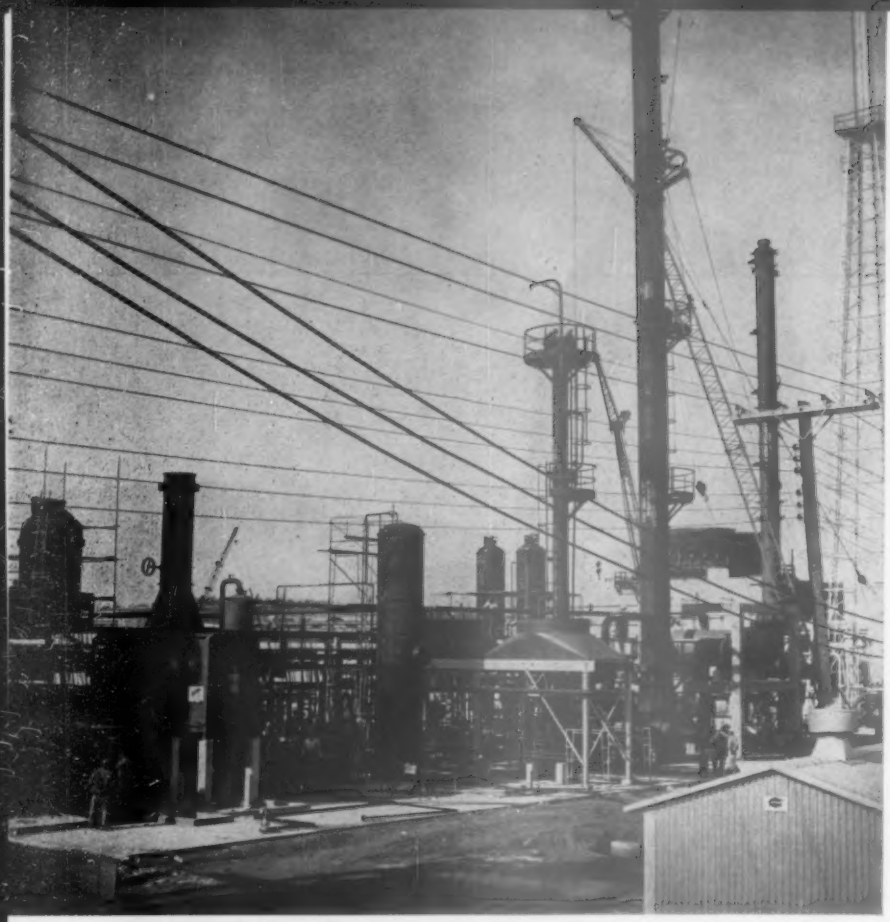
Airlift Australia

AUSTRALIA'S Snowy Mountains Scheme has presented some unusual challenges to BP as sole supplier of petroleum products. Some of these challenges have been met in unusual ways, such as fuel drops from aircraft.

This gigantic project, midway between Sydney and Melbourne, with its great dams, power stations, and miles of tunnels and aqueducts, is designed both to provide hydro-electricity and to divert irrigation water westwards into the parched plains.

British Petroleum is proud to be associated with the Snowy Mountains Scheme, one of the world's greatest engineering undertakings.

BP



BASIC MATERIALS, such as benzene, are high on the list of new petrochemical construction projects. This Hydeal unit at DX Sunray Oil Co.'s Tulsa refinery will double the plant's benzene production capacity to 1,200 bbl. per day. Completion is due in mid-1961.

CONSTRUCTION REPORT

Petrochemical expansion is skyrocketing

• The boom is still on. U. S. and Canadian companies are hustling to complete more than 120 projects currently under way or planned. The big emphasis is aromatics.

BY ROBERT B. BIZAL
Director, Editorial Research

THERE'S NOTHING stagnant about the petrochemical industry. It's moving ahead at a remarkable pace.

The latest Journal construction report shows that more than 120 new plants or expansion programs are under way or planned in the United States and Canada. This compares with about 98 in a comparable survey 6 months ago (OGJ, Dec. 5, 1960, p. 119).

No other branch of the oil and gas industry has so many new plant projects under way. There are actually more petrochemical construction projects than there are in gas-processing and refining combined.

Nearly half the petrochemical projects involve facilities for basic operations, indicating the extent of oil-company participation in this growing field.

Aromatic projects lead the pack, with about 23 projects, followed by polyolefins and olefins, with about 15 each. At least a dozen new rubber plants or expansion programs are included, and expansion in ammonia capacity continues to climb.

The big concentration is along the Gulf Coast and the Southwest. But other areas are by no means standing still. About 40 of the projects are located either in the eastern part of the country or in the Midwest. The report shows about 18 projects for Canada. Most of those in western Canada are gas-processing plants with sulfur recovery facilities.

Following is a plant-by-plant listing of all petrochemical projects in both countries:

ALLIED CHEMICAL CORP., Baton Rouge, La., is nearing completion of a polyether plant with initial capacity of 20,000,000 lb. per year. Raw material will be propylene oxide.

At Hopewell, Va., facilities with capacity of 40,000,000 to 50,000,000 lb. per year of caprolactam will be completed summer 1961.

At Los Angeles, Allied is expected to go on stream late 1961 or early 1962 with a new phthalic anhydride plant.

At Moundsville, W. Va., construction includes a 40% increase in capacity for chlorinated methanes.

Allied reportedly will build a new melamine plant with capacity of more than 20,000,000 lb. per year. Site not known.

AMERICAN CYANAMID CO. will go on stream by 1963 with a methyl methacrylate facility at Fortier plant, Avondale, La. Capacity will be 30,000,000 to 35,000,000 lb. per year. The company has purchased license from Imperial Chemical Industries, Ltd., Great Britain.

AMERICAN RUBBER & CHEMICAL CO., Louisville, Ky., is building facilities with initial capacity of 30,000 long tons per year of polyisoprene and polybutadiene. Completion expected by fall 1961. With modifications, this could be increased to 50,000 tons.

AMOCO CHEMICALS CORP., Joliet, Ill., is expanding dimethyl terephthalate capacity, with completion summer 1961. Present capacity of 12,000,000 lb. per year will be doubled.

Scheduled for completion in 1961 at Texas City are new facilities for doubling the company's hydrocarbon resins. Raw material will come from nearby American Oil refinery.

ARCHER-DANIELS-MIDLAND CO., Pe-

oria, Ill., will go on stream spring 1962 at new plant to make nitrogen compounds, plasticizers, and intermediate chemicals.

ARMOUR & CO., Sheffield, Ala., will have capacity of 250 tons per day of prilled ammonium nitrate, 360 tons of anhydrous ammonia, 300 tons of nitric acid, 50 tons of urea, and 240 tons of nitrogen solutions.

AURORA GASOLINE CO. is under way with a multimillion-dollar expansion at its Detroit refinery to provide benzene to Dow Chemical Co.'s Bay City, Mich., plant. Completion set for late 1961. Production will consist of about 20,000,000 gal. per year of aromatics mixture.

AVISUN CORP. is building a propylene resin plant with capacity of 75,000,000 lb. per year at New Castle, Del., with completion mid-1961.

BORANE CHEMICAL CORP. is building a research lab and plant at Montebello, Calif., for production of 2,000,000 lb. per year of synthetic polymers and intermediates. Products will include flexible air-drying polyesters, epoxy silicone polymers, diallyl isophthalate, and diallyl phthalate. Pilot-plant production set to begin late 1961.

BRITISH AMERICAN OIL CO., LTD., Montreal East, Que., is scheduled to complete a Udex unit this spring for extraction of benzene, with provision for production of other aromatics in the future. Cost will be more than $2,500,000. Contractor Foster Wheeler, Ltd., Canada.

BROCKVILLE CHEMICALS, LTD., Maitland, Ont., was due to complete a new plant this spring, for production of synthetic ammonia, hydrogen, nitrogen solutions, ammonium nitrate, and others, using natural gas from Alberta as raw material.

CALIFORNIA CHEMICAL CO., subsidiary of Standard Oil Co. of California, will complete a $17-million chemical complex at the Richmond refinery late 1961 or early 1962. It will have capacity of 41,000,000 lb. per year of paraxylene and 100,000,000 lb. of orthoxylene.

At Fort Madison, Iowa, California Chemical is expected to complete its $22-million fertilizer plant fall 1961. Capacity will be 150 tons per day of ammonium nitrate, 300 tons of anhydrous ammonia, and 600 tons of complex fertilizers.

At Oak Point, La., the company is building a $1-million addition for additives used in lubricating oil.

CANADIAN OIL COMPANIES, LTD., Sarnia, Ont., is doubling the plant's benzene production to 7,000,000 gal. per year, with completion scheduled June 1961.

CARY CHEMICALS, INC., East Brunswick, N. J., will expand its vinyl polymer, compounding, and calendering facilities, with monomer to come from a Tennessee Gas Transmission Co. plant near Houston.

CELANESE CORP. OF AMERICA will make acetyl chemicals at a new plant near Bay City, Tex. Capacity will be 100,000,000 lb. per year. Completion is scheduled early 1962 by Brown & Root, Inc. Initial production will be acetalydehyde and 2-ethyl hexanol. The process is licensed from Aldehyd G.m.b.H. of Germany. The process involves combination of oxygen and ethylene gas.

At Bishop, Tex., Celanese has plans for a $10-million plant to produce about 20,000,000 lb. per year of a new polyaldehydes product, a copolymer of trioxane and an unidentified material. Completion expected by 1962.

CHEMOIL CORP. is planning a $60-million refinery between Baton Rouge and New Orleans. Output will include ethylene and propylene. Completion scheduled in 1963.

CITIES SERVICE and **THIOKOL CHEMICAL CORP.** are reportedly discussing plans for a butyl rubber plant.

COLUMBIAN CARBON (CANADA), LTD., Hamilton, Ont., will complete a 40,000,000-lb. per year carbon-black plant in mid-1961 at cost of $5 million.

CONTINENTAL CARBON CO. will complete a $4-million carbon-black plant near Bakersfield, Calif., by early summer 1961. Ralph M. Parsons Co. has contract. Capacity will be 30,000,000 lb. per year.

COPOLYMER RUBBER & CHEMICAL CORP., Baton Rouge, La., will complete an expansion in butadiene capacity in July 1961. Capacity will be increased to $55,000 tons per year at a cost of $5 million.

CROWN CENTRAL PETROLEUM CORP., Houston, will complete new benzene unit with capacity of 17,000,000 gal. per year mid 1961. Catalytic Construction Co. is contractor.

DIAMOND ALKALI CO., Deer Park, Tex., is building a 40,000,000-lb. per year plant to make acetylene from methane and oxygen. Also, an ammonia unit will be built this summer as a part of the acetylene complex. Completion by C. F. Braun & Co. expected early 1962.

DOW BADISCHE CHEMICAL CO., Freeport, Tex., will complete facilities for production of 40,000,000 lb. per year of caprolactam January 1962.

DOW CHEMICAL CO., Saginaw, Mich., will add polyolefin facilities.

At Freeport, Tex., Dow is building a large unit for 30,000,000 gal. per year of benzene.

Dow is building a 36,000,000-lb. per year phenol plant at Kalama, Wash., with completion by Hoffman Construction Co. mid-1962.

At Plaquemine, La., Dow will build a second polyolefin plant capable of producing medium and high-density polyethylene, copolymers of ethylene, and polypropylene. Completion of the $6-million plant is set for second quarter 1962.

At Williamsburg, Va., Dow will complete facilities for 12,000,000 lb. per year of nylon 6 late 1961.

DOW CHEMICAL OF CANADA, LTD., Sarnia, Ont., is adding facilities to produce propylene oxide, propylene glycol, and polyglycol.

At Fort Saskatchewan, Alta., facilities for glycols and amines will be complete late 1961.

At Vancouver. B.C., facilities for 24,000,000 lb. per year of phenol will be on stream mid-1961, with benzene as raw material.

DU PONT DE NEMOURS & CO., E. I., Beaumont, Tex., will complete new 10,000,000-lb. per year acrylonitrile plant late 1961 or early 1962.

Du Pont is expanding its methanol capacity 35% at Sabine River, Tex., and Belle, W. Va. Expansion will total 30,000,000 gal. per year.

At Huron, Ohio, Du Pont will build a multimillion-dollar plant with capacity of 30,000,000 gal. per year of methanol. Construction may start late 1961.

At Montague, Mich., the company plans to build a plant to produce as much as 50,000,000 lb. per year of acetylene from hydrocarbons. These facilities would supply a neoprene plant at Montague. The acetylene plant is scheduled for completion early 1963.

DX SUNRAY OIL CO., Tulsa, Okla., will double benzene producing capacity to 1,200 bbl. daily with completion of new Hydeal unit mid-1961.

EL PASO NATURAL GAS PRODUCTS CO., Odessa, Tex., is expanding with a 900-bbl. per day benzene unit in 1961.

EL PASO NATURAL GAS PRODUCTS CO. and **REXALL DRUG & CHEMICAL CO.,** Odessa, Tex., are building facilities for 150,000,000 lb. per year of ethylene and 120,000,000 lb. of high-pressure polyethylene, with completion January 1962. Facilities for propylene, linear polyethylene, and polypropylene are also included in the program.

ESCAMBIA CHEMICAL CORP. plans a new plant for methacrylates, with work to start about mid-1961 and completion in 1962. Site unknown.

FOSTER GRANT CO., INC., Beaumont, Tex., will go on stream with 12,000,000-lb. per year high-pressure polyethylene plant mid-1961.

GENERAL TIRE & RUBBER CO. has awarded contract to Crawford & Russell, Inc., for design and engineering of pilot plant at Mogadore, Ohio, for both continuous and batch polymerization of isoprene and butadiene to produce stereospecific synthetic rubbers. Starting and completion dates unknown.

GOODRICH-GULF CHEMICALS, INC., is building a cis-polybutadiene plant with capacity of 20,000,000 lb. per year at Institute, W. Va. Contractor is Blaw-Knox Co. Completion scheduled by end of 1961.

GOODYEAR TIRE & RUBBER CO., Akron, Ohio, will expand facilities for production of nitrile and styrene-butadiene latexes. The 15% expansion will be completed by June 1961.

At Beaumont, Goodyear will have capacity of 20,000 tons per year of polybutadiene, with completion late 1961, and 20,000 tons per year of polyisoprene, with completion in 1962.

GRACE & CO., W. R., is expanding its polyethylene plant at Baton Rouge, La., with size of expansion not revealed. Fluor Corp., Ltd., has design contract. Completion August 1961.

At Big Spring, Tex., Grace will build a 60,000-ton per year ammonia plant, with Foster Wheeler Corp. holding contract. Completion scheduled early 1962.

GULF OIL CORP., Philadelphia, will build a multimillion-dollar benzene unit.

HERCULES POWDER CO., Lake Charles, La., is doubling its polyolefins facilities to 120,000,000 lb. per year, with completion 1962.

HEYDEN NEWPORT CHEMICAL CORP. will build a polyformaldehyde plant, probably near its formaldehyde plant at Garfield, N. J.

HOME OIL CO., LTD., has approval to expand its Carstairs gas-processing plant in Alberta. Production will include 1,413 tons per day of sulfur. Completion scheduled November 1961.

HOOKER CHEMICAL CORP., South Shore, Ky., will use benzene as raw material at a phenol plant to be completed by end of 1961.

HOUSTON CHEMICAL CORP., Beaumont, Tex., will complete new facilities for production of tetraethyl and tetramethyl lead and ethylene oxide and derivatives mid-1962. Cost of the plant will be $10 million. Singmaster & Breyer has contract.

HUMBLE OIL & REFINING CO., Baytown, Tex., will expand paraxylene capacity from 65,000,000 to 105,000,000 lb. per year by first quarter 1962. Capacity of benzene will be increased from 30,000,000 to 55,000,000 gal. per year, and toluene from 32,000,000 to 55,000,000 gal. per year.

At Baton Rouge, La., butyl rubber capacity is being increased by 18,000 long tons per year second quarter 1961. Humble also plans to manufacture more than 15,000,000 lb. per year of 2-ethyl hexanol at Baton Rouge.

At the Bayway, N. J., refinery, ethylene-producing capacity will be expanded 35% to 175,000,000 lb. per year, with completion second quarter 1962.

HUNT OIL CO. will start construction this spring on a $2,000,000 gas-processing plant near McGregor, N. D. Recovery will include 8 long tons of sulfur per day.

IMPERIAL OIL LTD., Sarnia, Ont., will complete a 30,000,000-gal. per year benzene plant in the fall of 1961 at estimated cost of $5 million. Contract awarded to Canadian Bechtel, Ltd.

IOWA-ILLINOIS GAS & ELECTRIC CO. reportedly plans facilities for such products as polyethylene and polypropylene plastics, ethylchloride and other chemicals in the Midwest, based on LPG from a new gas-processing plant in Bushton, Kans., to be operated by Northern Gas Products Co.

JEFFERSON LAKE PETROCHEMICALS OF CANADA, LTD., will operate sulfur recovery facilities at a proposed gas-processing plant to be built by Petrogas Processing, Ltd., at Calgary field, Alberta. Recovery will include 863 long tons per day of sulfur, with completion December 1961.

Near Coleman, Alta., Jefferson Lake will own and operate sulfur recovery facilities adjacent to a proposed $11-million gas-processing plant to be built by Saratoga Processing Co., Ltd. (Westcoast Transmission Co.). Sulfur recovery will amount to 370 long tons per day, with completion November 1, 1961. Canadian Bechtel, Ltd., has contract for the plant.

MOBIL CHEMICAL CO., Beaumont, Tex., will complete a plant to produce more than 30,000,000 gal. of benzene annually early in 1962. Toluene will also be produced.

MOBIL OIL OF CANADA, LTD., has in the early planning stage a gas-processing plant in the Wimborne area of Alberta. Recovery at such a project would include 140 long tons of sulfur per day.

MONOCHEM, INC., is building a $20-million acetylene and vinyl chloride monomer plant at Geismar, La., with completion late 1962. Chemical Construction Corp. and United Engineers & Constructors, Inc., are contractors. Monochem is owned by Borden Co. and U. S. Rubber Co. Plans call for both firms to erect plants nearby to make use of Monochem's raw output.

MONSANTO CHEMICAL CO., Addyston, near Cincinnati, is building a new plant with 50,000,000 lb. per year capacity of styrene-based plastic materials. Completion slated late 1961. Styrene monomer will come from Texas City.

In Gloucester County, New Jersey, Monsanto is building a phthalic-anhydride plant and a 20,000,000-lb. per year benzylchloride plant. Completion early 1962.

At Chocolate Bayou, near Alvin, Tex., Monsanto will complete a big complex in 1962, with Bechtel Corp. as prime contractor. In addition to ethylene capacity of 500,000,000 lb. per year, the plant will have 42,000,000 gal. per year capacity for benzene, 50,000,000 lb. naphthalene, and unannounced amounts of propylene, cumene, phenol, acetone, ethyl benzene, oxo alcohols, and others.

At Texas City, Monsanto's program includes completion of a new phenol plant spring 1962, with capacity of 50,000,000 to 75,000,000 lb. per year. Capacity of vinyl chloride monomer is being boosted by 50%, with completion by July 1961. High-pressure polyethylene capacity will be increased 30%, with completion early 1962.

NAUGATUCK CHEMICAL, Division of U. S. Rubber Co., Baton Rouge, La., will complete a pilot plant for making synthetic-stereo regular rubber fall 1961, at cost of $2 million. Initial production will concentrate on ethylene-propylene copolymer and synthetic balata.

NOPCO CHEMICAL CO. will complete a new isocyanate plant near Linden, N. J., early 1962. Contractor is Bechtel Corp. Design capacity is reportedly 10,000,000 lb. per year. Principal product will be toluene diisocyanate.

OXO CHEMICALS CO. (owned by Pittsburgh Chemical Co. and Amoco Chemicals Corp.) is building a multimillion-pound per year isoocytl and decyl alcohol plant at Haverhill, Ohio, with completion early 1962.

PAN AMERICAN PETROLEUM CORP. is building a new gas-processing plant near Whitecourt, Alta., which will include recovery of 620 long tons of sulfur per day. Completion by Brown & Root, Inc., expected 1962.

PETRO-TEX CHEMICAL CORP., Houston, is building a maleic anhydride plant with capacity of 30,000,000 lb. per year, and a tetrahydrophthalic anhydride unit, with completion October 1961. Petro-Tex is owned by Tennessee Gas Transmission Co. and Food Machinery & Chemical Corp.

PHILLIPS CHEMICAL CO. was to complete expansion of polyethylene facilities at Pasadena, Tex., in 1961.

At Sweeny, Tex., Phillips Chemical was due to complete ethylene expansion in 1961.

PHILLIPS PETROLEUM CO., Sweeny, Tex., will begin shipments mid-1961 at its new 22,000,000-gal. per year benzene plant.

PLYMOUTH OIL CO., Texas City, will complete Udex unit for benzene and other aromatics by July 1, 1961. Procon, Inc., has contract. Benzene capacity at the refinery will be 15,000,000 gal. per year.

POLYMER CORP., LTD., Sarnia, Ont., will build a multimillion-dollar polybutadiene plant with completion expected before the end of 1962. Estimated output will be 20,000 tons per year. The process will be carried out under licenses from Prof. Karl Ziegler of Germany and Goodrich-Gulf Chemicals, Inc.

PURE OIL CO. will build an aromatics extraction unit at its Lemont, Ill., refinery, with capacity of 26,000,000 gal. per year. Completion scheduled November 1961.

PURE OIL CO. and **ATLANTIC REFINING CO.** have made a joint agreement to produce 50,000,000 gal. per year of benzene, toluene, and xylene, with completion of a Udex unit at Pure's Nederland, Tex., refinery scheduled by December 1961. Feed will come from existing catalytic reformers at the Nederland plant and Atlantic's Port Arthur refinery. M. W. Kellogg Co. is contractor.

REGENT REFINING (CANADA), LTD., Port Credit, Ont., will place a $2,000,000 benzene and toluene plant on stream mid-1961. The plant is being engineered by Universal Oil Products Co.

REICHHOLD CHEMICALS, INC., will build a plant in the Houston area to make vinyl acetate. The expansion might include an acetylene plant. Plant will cost at least $10 million, with initial capacity of 50,000,000 lb. per year.

REXALL DRUG & CHEMICAL CO. will complete a polystyrene plant near Chicago late 1961. Capacity will be 25,000,000 lb. per year. Styrene feed stocks for the new plant will be supplied by El Paso Natural Gas Co.

For further Rexall construction see El Paso Natural listing for Odessa project. In addition, Rexall is now reportedly planning to move into industrial agricultural and fermentation chemicals.

ROHM & HAAS CO. is renovating the former government plant at Louisville, Ky., and will produce methyl methacrylate monomer, acrylic molding powder, and ammonium sulfate. The $12-million project will go on stream mid-1961.

SHAMROCK OIL & GAS CO. will build an ammonia plant at its Sunray, Tex., refinery, with capacity of 150 tons per day. Completion early 1962.

SHELL CHEMICAL CO. is building an 80,000,000-lb. per year polyisoprene plant 15 miles west of Marietta, Ohio. Completion by C. F. Braun & Co. and Ralph M. Parsons Co. is expected late 1961. Feed stock will come from Shell Oil's Wood River, Ill., refinery.

At Woodbury, N. J., Shell Chemical

will build an 80,000,000-lb. per year polypropylene plant, with completion in 1962. The company also has another New Jersey plant site north of Camden.

SHELL OIL CO. will build a gas-processing plant in Bryans Mill field, Cass County, Texas, with recovery to include 130 long tons of sulfur per day. Brown & Root, Inc., has contract. Completion November 1961.

SHELL OIL CO. OF CANADA, LTD., will complete a gas-processing plant in the Pincher Creek area of southwestern Alberta latter part of 1961. Canadian Bechtel, Ltd., has contract. Recovery will include 1,100 long tons of sulfur per day.

SINCLAIR-KOPPERS CHEMICAL CO. will complete a styrene plant at Pasadena, Tex., mid-1961. Capacity will be 70,000,000 lb. per year. Ethylbenzene for the plant will come from Sinclair Oil's Houston refinery. Badger Manufacturing Co. is contractor.

SOLAR CHEMICAL CORP., Leominster, Mass., is expanding its polystyrene capacity.

SOLAR NITROGEN CHEMICALS, INC., Joplin, Mo., is building a urea plant based on a Dutch State Mines process. Plant will be adjacent to a new ammonia plant at Joplin. Completion by Arthur G. McKee & Co. October 1961.

SUN OIL CO. is building a $9,300,000 gas plant at its Marcus Hook, Pa., refinery. Capacities of various products will include 7,100 bbl. per day of liquefied propane and propylene. Completion November 1961.

At the Toledo, Ohio, refinery, Sun will complete a 100,000,000-lb. per year naphthalene plant late 1961 at cost of $8,000,000. M. W. Kellogg Co. has contract.

SUNOLIN CHEMICAL CO., North Claymont, Del., is adding facilities to produce 225,000,000 lb. per year of ethylene and 55,000,000 lb. per year of ethylene oxide, using dry gas as raw material. Completion of the $20,000,000 project will be late 1961.

SUNTIDE REFINING CO., Corpus Christi, is adding facilities for 30,000,000 lb. per year of ethylbenzene, with completion by Badger Manufacturing Co. early July 1961. New facilities to produce 60,000,000 lb. per year of styrene will be on stream early 1962.

TENNECO OIL CO., subsidiary of Tennessee Gas Transmission Co., Chalmette, La., was expected to complete new facilities mid-1961, including 2,200-bbl. per day extraction unit for benzene, toluene, and xylene; 20,000,000-lb. per year orthoxylene fractionator; and 22,000,000-lb. ethylbenzene fractionator. Bechtel Corp. and Badger Manufacturing Co. are contractors.

TENNESSEE GAS TRANSMISSION CO. will build a complex on the Houston Ship Channel, with completion in 1962. Capacity will be 100,000,000 lb. per year of acetylene, and 200,000,000 lb. per year of vinyl chloride monomer, as well as vinyl acetate monomer and probably ammonia.

TEXACO CANADA LTD., Port Credit, Ont., will complete a benzene plant mid-1961.

TEXACO INC., Port Arthur, Tex., will go on stream with a Udex unit and other facilities to produce 30,000,000 gal. per year of benzene in 1962.

TEXAS BUTADIENE & CHEMICAL CORP. reportedly may build a plant for commercial production of low molecular-weight styrene-maleic anhydride resins. The company now has semicommercial production in South Miami, Fla.

TEXAS EASTMAN CO., Longview, Tex., has started large-scale production of polypropylene from propane. By mid-1961, the new unit will achieve annual capacity of 20,000,000 lb.

TEXAS-U. S. CHEMICAL CO. reportedly is expected to reveal plans for a new polybutadiene plant shortly, likely at Port Neches, Tex., with probable plant size of 20,000 long tons per year.

TIDEWATER OIL CO. and **AIR PRODUCTS, INC.,** plan a new oxo-alcohols plant with capacity of 60,000,000 lb. per year at Tidewater's Delaware City refinery.

TIDEWATER OIL CO. and **COLLIER CARBON & CHEMICAL CORP.** are expected to complete a naphthalene plant of 100,000,000-lb. per year capacity at Delaware City late 1961. Catalytic Construction Co. has contract.

At Wilmington, Calif., the two companies are considering a 50,000,000-lb. naphthalene plant.

UNION CARBIDE CARIBE, INC., Ponce, Puerto Rico, will complete new polyethylene facilities second half of 1962, with capacity of 110,000,000-lb. per year. Cost will be $20,000,000.

UNION CARBIDE CHEMICALS CORP. is increasing low-density polyethylene capacity by 170,000,000 lb. per year at Seadrift and Texas City plants, with completion in 1961.

UNION TEXAS NATURAL GAS CORP. will reportedly build a 200,000,000-lb. per year ethylene plant somewhere along the Louisiana Gulf Coast.

UNITED CARBON CO., Mojave, Calif., is building a 64,000,000-lb. per year carbon-black plant, with completion early 1962. Cost will be $5 million. Lummus Co. is contractor.

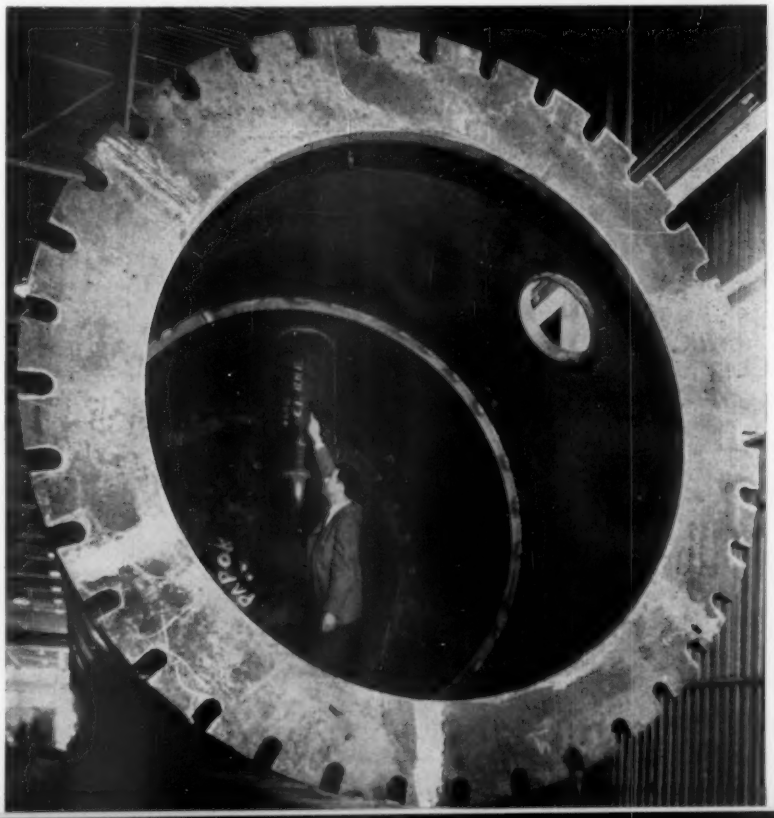
U. S. INDUSTRIAL CHEMICALS CO., Houston, is building a linear polyethylene plant with capacity of 60,000,000 lb. per year. Completion expected fourth quarter 1962.

U. S. PHOSPHORIC PRODUCTS is building an ammonia plant with capacity of 350 tons per day at Tampa, Fla. Chemical Construction Corp. has the contract. Completion set for late 1961. Natural gas will be raw material.

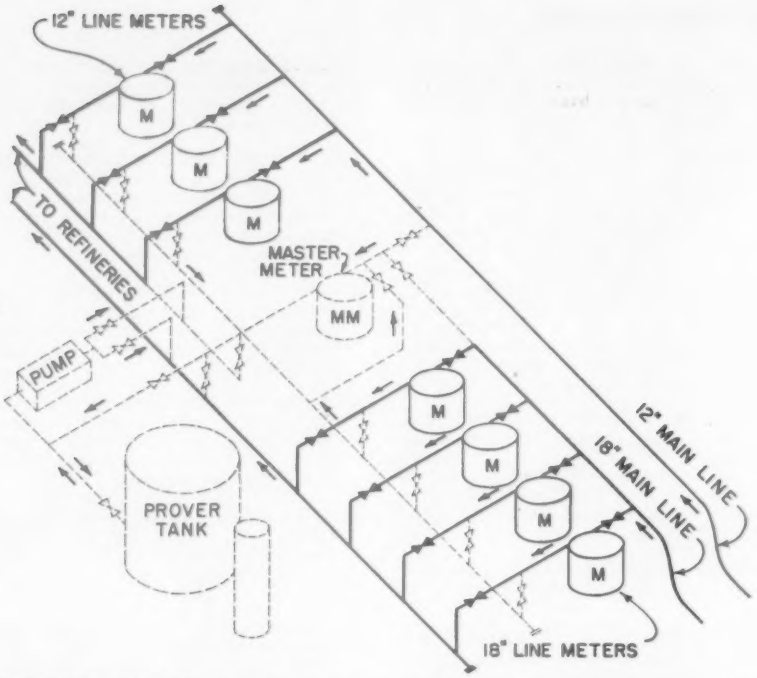
WESTERN LEASEHOLDS, LTD., subsidiary of Canadian Petrofina, Ltd., will build a gas-processing plant in Wildcat Hills field, Alberta, with recovery to include 50 tons of sulfur per day. Completion late 1961.

WITCO CHEMICAL CO. will build a 30,000,000-lb. per year phthalic-anhydride plant somewhere on the East Coast. Contractor is Scientific Design Co., Inc.

AN ETHYLBENZENE unit, designed for 30,000,000 lb. per year capacity, is being built by Suntide Refining Co. at Corpus Christi, Tex. Here is one end of a 203-ft. vessel which will be used as a fractionating tower. The vessel was transported on six flatcars.



P.D. meters end discrepancies, gaging at pipeline terminal



SCHEMATIC DIAGRAM of metering system installed at Montreal East terminal of Portland-Montreal Pipe Line System. Fig. 1.

Only one failure in 17 months of operation reported on Portland-Montreal system

BY G. S. SCHONEWALD
Senior Engineer,
Portland-Montreal Pipe Line System

POSITIVE-DISPLACEMENT meters were installed at the Montreal East terminal of the Portland-Montreal Pipe Line System in 1958 to handle deliveries to refinery tankage more efficiently. They have done just that.

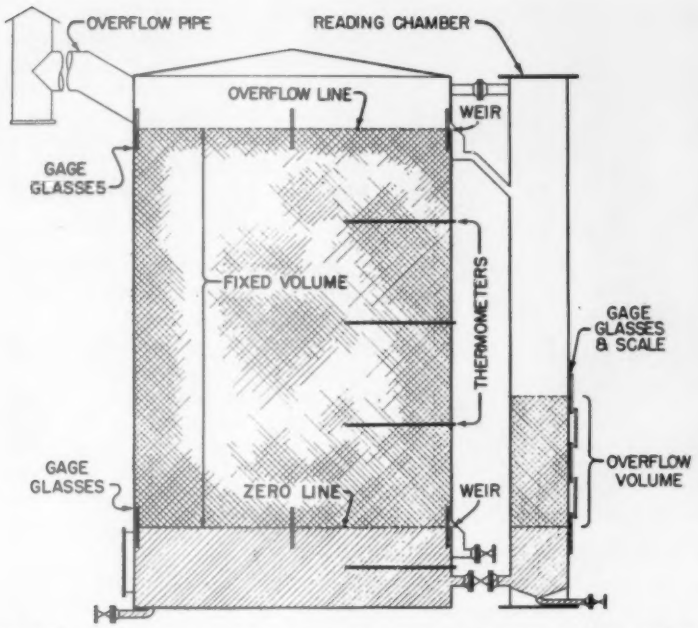
All tank gaging, except check gages to make sure that streams have been routed correctly and that sufficient empty tankage exists to accept proposed deliveries, has been eliminated.

Hourly throughput can be determined exactly at the correct time with "combinators" and this, along with eliminating errors due to opening with bad bottoms, has greatly improved the hourly line-stream control.

Discrepancies in amounts of oil delivered because of inaccurate measurements by tank gaging (caused by buckling tank bottoms), deep acculated sediment in tank bottoms causing poor opening gages, and tank-strapping inaccuracies have been eliminated.

Dual main line. The Portland-Montreal system transports crude oil from South Portland, Me., to Montreal East, Que. South American and Middle East crudes varying from 35 to 650 S.s.U. are brought by tankers to South Portland. They

EIGHT METERS with dual printer heads and 18-in. line combinator heads. Fig. 2.



PROVER TANK, 12 ft. in diameter, has upper and lower weirs to define fixed volume of intervening 15-ft. height. Fig. 3.

HYDRAULIC VALVE OPERATORS, shown here on 4-in. valve between tank and chamber, are economical and reliable. Fig. 4.

are pumped through the 12-in. or the 18-in. main line, each with eight pumping stations, to the terminal at Montreal East. A manifold on each line directs the oil to refineries owned by six companies which use the system.

Meters in parallel. Three meters in parallel were installed on the 12-in. trunk line which has a capacity of about 3,040 bbl. per hour (Fig. 1). A four-meter bank was installed on the 18-in. line, with a capacity of about 8,540 bbl. per hour. An eighth meter is interchangeable between both sets and can serve as a spare. It is principally used as a master meter for series calibration of the individual meters. It is also used to measure deliveries of oil temporarily stored in the company-owned Montreal East Terminal tankage.

The meter heads of each bank are connected through a mechanical linkage so that the throughput of each meter is added arithmetically and recorded on an additional meter-head assembly called a "combinator." For hourly dispatching reports, only the combinator of each line-meter bank need be used.

The meters and the combinator of each bank have two counter and ticket-printer heads. These are mounted on a solenoid-operated shifting device which transfers the meter drive from the upper to the lower counter-printer head and vice versa without stopping the meter. Shifting of the drives to the counter-printers is done simultaneously on all meters and the combinator of a bank by pressing a button. It is done halfway through the operation of swinging valves to shift the stream from one refinery to another as the tender head arrives.

The tickets of the completed tender are printed and removed from the disconnected printer heads while the registration of the delivery measurement for the newly arrived tender is proceeding on the other set of counter-printer heads.

Meter Calibrating

A 300-bbl. double-weir type of prover tank is used for calibrating the p.d. meters. This prover tank, Fig. 3, is a 12-ft.-diameter tank with lower and upper weirs that define a fixed volume in the 15-ft. height between the weirs. The tank is connected to a 26-in. diameter "reading chamber" by 4-in. pipes at the bottom and at the top. The latter directs the overflow of the top weir into the chamber.

A common "zero level" is established in the tank and in the reading chamber by filling the tank and chamber until it overflows the lower weir with the bottom connecting pipe open. When zero is established, the lower-weir drain valve and the bottom 4-in. connection valve are closed.

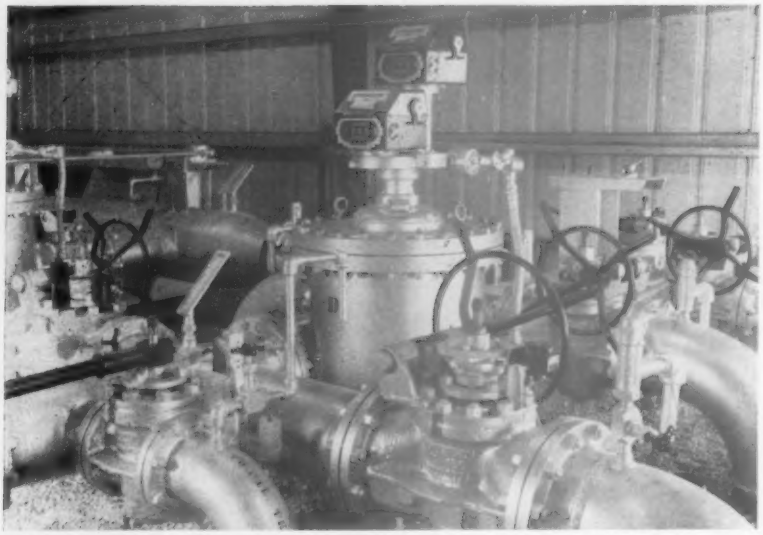
Meters are calibrated by running oil through the meter into the prover tank until oil overflows the top weir and enters the reading chamber. The fixed volume in the tank plus the overflow volume are read on scale plates on the chamber.

The same time is allowed for oil to overflow the bottom weir establishing zero as is allowed for oil to overflow the top weir so that final conditions exactly match initial conditions in the meter-calibrating operation.

Operating Problems

In the first 6 months some unexpected problems were encountered, some due to severe winter climate. Initial meter-factor plots showed a much wider range than could be explained by changes in viscosity and flow rate from tender to tender.

The temperature compensators were removed from the meters and temperature correction was calculated by averaging temperatures of mercury thermometers in each of the incoming crude-oil streams and



DOUBLE CYLINDER key interlock pieces are within handwheels to right and left of "D" meter. Fig. 5.

by applying temperature - volume correction factors. The clutch-type calibrator assemblies were removed and a solid-shaft drive was installed between the rotating element output and the counter-printer heads.

Another problem was the buildup of wax on the cold walls of the uninsulated outdoor prover tank.

An insulated building was built to house the prover tank. This made it possible to use water-operated plug valves. A forced hot-water system using electrical immersion heaters was installed. Fin-tubed radiators were put in, one for normal room heating and one on the bottom of the prover tank with a smaller coil in the bottom of the reading chamber, all below the zero line. Heating the empty tank after calibrations in the winter until its shell temperature is about 90° F. and keeping it there for about 8 hours has proved enough to prevent wax accumulation on the tank walls.

Automatic Proving

To achieve maximum accuracy by eliminating variations due to tender viscosity and gravity changes, meters are calibrated after each significant change in crude type. Management decided to automate the meter-proving operation insofar as practical to save time and to eliminate the human element as far as possible, thus assuring uniform calibrating techniques. Safety features to prevent prover-tank overflow were included.

Automated meter proving has two cycles. The first, the prover-tank filling cycle, is started by directing oil into the tank at the proper flow rate. The balance up to the operator's reading the calibration-tank scale plate, is automatic. As oil entering the tank approaches the overflow weir, a capacitance probe is submerged. It energizes a circuit to close a motor-operated plug valve to stop the flow.

At the same time a 15-minute time delay is actuated to provide the necessary timed overflow of oil over the top weir. Should this probe fail, a float-operated mercury switch energizes a separate electrical circuit to close the valve to shut off the oil stream at a slightly higher level in the tank and also sound an alarm. When the 15-minute drainover period expires, an alarm sounds and a light flashes, telling the operator it is time to read the tank volume on the reading-chamber scale plate.

Second cycle. The second cycle, draining and zeroing the prover tank, starts with the prover-tank drawdown pump. The prover tank is drawn down at the rate of about 1,000 bbl. per hour. When the oil level nears the zero line, a second capacitance probe is uncovered to actuate a relay and stop the drawdown pump.

This probe actuates a second relay which directs water pressure into a hydraulic operator attached to the 4-in. valve which is opened to equalize the level of the chamber and the tank. This valve also directs water pressure into a second hydraulic valve operator which opens a 3-in. valve to allow drainage to flow over the bottom weir into the sump system. This positioning of valves zeroes the prover tank at the bottom-weir level.

Hydraulic operators. Hydraulic-valve operators were used for these 3 and 4-in. plug valves. They are less expensive than electric-motor operators. It had been planned to use compressed air to actuate these operators. Long outside air lines could be eliminated by using water pressure available inside the new building. The hydraulic-valve operators proved very economical and reliable (Fig. 4).

The bottom probe which opens the water-operated plug valves also actuates a timer to give the 15-minute waiting period required to permit oil to drain over the bottom weir and establish the zero line in the prover tank and chamber. This period is the same as that for oil to overflow the top weir at the close of the filling operation.

Following expiration of the zeroing period, the automatic timer sequence closes the water-operated plug valves to seal the chamber from the prover tank and to close the drain valve from the bottom-weir box. The prover tank is thus in a position to again receive oil for another meter-calibrating run.

A 745-Imp.-gal. tank with a "Seraphin" neck was tied in with the prover tank for calibrating the larger tank. The size is such that the water from the 300-bbl. prover tank will fill it a certain number of times leaving a very small residue to be handled in 1 and 5-gal. test measures.

Key Interlock System

Once, as a result of incorrectly positioning certain valves of the p.d. meter manifold, oil from the 12-in. trunk line was mixed with oil from the 18-in. trunk line for a brief period. To eliminate a recurrence, a key interlock system was installed on the p.d. meter system valving.

The system consists of adapters for plug-valve wrenches and plug valves so that only the proper wrench will fit the corresponding valve. The valve handles are se-

cured in racks by locks. The worm-gear-operated plug valves are locked in position.

Foolproof method. To set up the p.d. meter manifold for a certain operation, an operator obtains the supervisory key. He unlocks a key retainer to obtain necessary plug-valve handles and a system key to operate the worm-gear plug valves of one of three oil routes, each with a color code. Having obtained a system key, the operator can manipulate the necessary valves of the system and of that system only, and only in the proper order. To prevent faulty sequence of valve manipulation within a system, key retainers are installed on the worm-gear locks of the first valve of a series. After unlocking this first valve in the sequence, the system key is held and the key for the next valve of the sequence is released. The key for the third valve in the sequence is similarly obtained.

The key interlock system seemed prohibitively complex. In practice, however, by color coding and instruction with a reference diagram, personnel readily learned to use the system.

Terminal operators appreciate its value as a safeguard which frees them from the constant need to exercise extreme caution to avoid opening the wrong valve at the wrong time or in the wrong sequence.

Meter Maintenance

To appraise metering performance, the meter factors of each meter are plotted on a day-to-day basis with the flow rate of the calibration, the average gravity of the oil, and the crude type. Any erratic behavior is reflected by an unusual deviation from the previous meter factor. This could represent a mechanical failure or abrasive material opening up clearance spaces. The result of either would show an unusual increase in meter factor caused by the excessive oil slippage.

Normal variations in flow rate and gravity produce minor changes in meter factor from calibration to calibration. A meter in good operating condition, properly calibrated, should produce a plot of meter factors which will fall within a band of approximately plus or minus 0.0010 (0.1%). A gradual drift of meter factor beyond this limit generally indicates a need for a meter-maintenance overhaul.

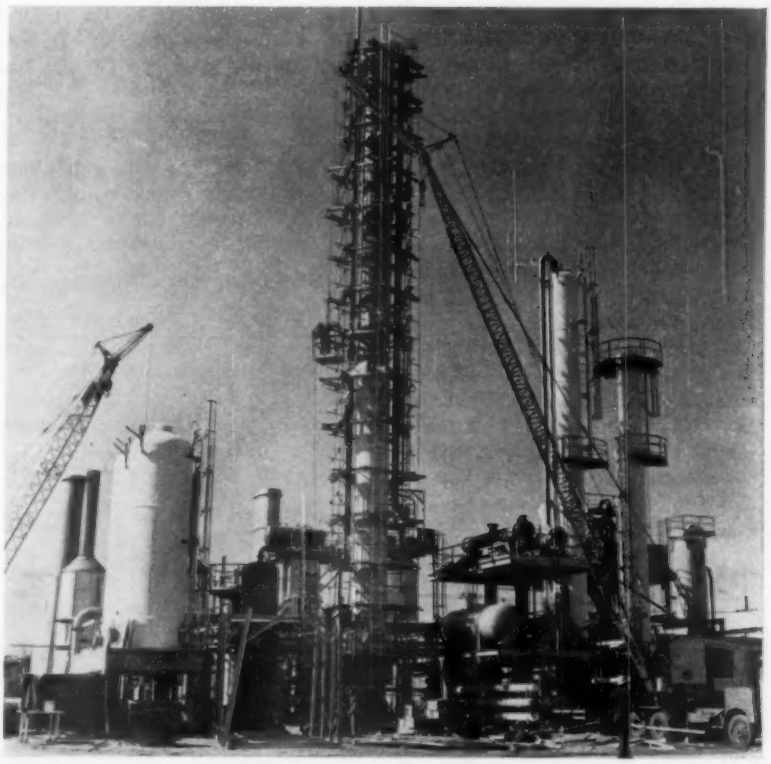
It is the practice of Montreal Pipe Line Co., Ltd., to overhaul meters semiannually. On this basis, each 18-in. line meter has about 8,000,000 bbl. and each 12-in.-line meter, about 4,000,000 bbl. of service between overhauls. Meter elements are alternated between 12-in. and 18-in. lines to equalize wear.

Standard deviations. Another record of meter performance kept is the standard deviation of meter factors on a monthly basis. This is a statistical tool representing the square root of the average of the squares of the deviations of the daily meter factors from the average monthly meter factor and is used to evaluate meter accuracy.

Standard deviations for each meter are reviewed monthly to determine if accuracy is up to standard. Generally, the average deviations of all meters at Montreal East is less than 0.0005, which is considered to be exceptionally good p.d. metering.

Turning over a complex mechanical-hydraulic system to personnel accustomed to tank-gaging operations presented a challenge in on-the-job training. This was met successfully. The men doubted their ability to handle the new equipment and new calculations, but before long, under careful guidance, they mastered the situation and developed pride in the precision with which they could calibrate meters and operate the new facilities.

The p.d. metering system at Montreal East terminal was placed in service on Aug. 1, 1958. Between this date and Jan. 1, 1961, there has been only one meter failure requiring a resort to tank gaging.



New benzene-recovery unit at Dow Chemical Co.'s Freeport, Tex., plant was scheduled to go on stream in May. Photo shows finishing touches being applied to the tallest tower in the unit. The new unit will make a large part of the benzene required for styrene production at Freeport. Feed stocks will come from both internal and purchased sources.

New ton-mile tables make it easier to GET FULL LIFE FROM YOUR RIG'S WIRE LINE

An easier way to keep track of the work done by the drilling line will help the driller get longest possible service from it. The charts in this article were compiled from electronic - computer data. Their use and the principles outlined will yield a cutoff and line-slippage program which will keep wear from concentrating in any one spot.

BY R. G. DULL
Coordinating Field Engineer,
Union Wire Rope Div. of
Armco Steel Corp.

IT HAS ALWAYS been a problem for a driller to keep track of the service he gets from his rig's wire line. The ton-mile system of accumulated service has proved best, but calculating this figure is often difficult and involved.

To simplify the process, an IBM 705 computer has been assigned the task of preparing tables which cover practically all drilling situations. A total of 462 ton-mile tables has been completed. If you understand the principles of wire-line cutoff, as explained in this article, if you apply these new charts to your particular rig, you can set up a good systematic cutoff procedure that will save you money.

Most rigs have for a number of years used some cutoff plan to improve safety and increase line life. Intent is to remove line at the drum end and spread wear throughout the line's length instead of accumulating wear in one spot. Nevertheless, many ropes have been discarded because of wire breakage in a very small section while the remainder is in good condition. This is a waste of good rope.

The key is cutting the **proper length** at the **proper time.** In the past it has often been hard to determine the proper length and the proper time because it is hard to account for the ton-miles of work done by the line. Reason is that there are many different operations and much different equipment at work. For instance, there are 13 sizes of API drill pipe and 19 sizes of drill collars. Either air, mud, or water may be the drilling fluid. And, in some areas, excess weight on the string may exceed 100,000 lb.

Thus, it isn't hard to see why 462 separate tables are needed. Table 1 is from the group; we'll learn how to use it later in the article. The new charts account for drill-pipe sizes from 2⅜-in. o.d. to 6⅝-in. and for drill collars from 4⅛-in. o.d. through 8-in. The charts also provide for either air or mud drilling to depths of 25,000 ft. Excess weights to 10,000 lb. are included.

Length to Cut

The proper length to cut is half the solution to a good cutoff practice. In the rotary reeving system there are numerous areas where the rope receives increased wear. Two in particular are: (1) points of drum crossover and (2) the so-called "points of critical wear."

Drum-crossover points. The drum crossover is the point on the drum where each lap of the second layer of wire rope crosses over each lap of the first layer of wire rope. Naturally, the third layer crosses over the second layer, etc. While picking up heavy loads of drill pipe, there is severe crushing and wear on the drum where the rope crosses over.

You can move a section of rope

TABLE 1—ROUND TRIP TON-MILES

4½-in. drill pipe; 16.6-lb./ft. weight; drilling fluid, 75-lb./cu. ft. mud; excess weight, 30,000 lb.

Depth	0	100	200	300	400	500	600	700	800	900
0	....	1	2	4	5	6	7	9	10	11
1,000	13	14	16	17	19	20	22	24	25	27
2,000	29	30	32	34	36	37	39	41	43	45
3,000	47	49	51	53	55	57	59	62	64	66
4,000	68	71	73	75	78	80	82	85	87	90
5,000	92	95	97	100	103	105	108	111	114	116
6,000	119	122	125	128	131	134	137	140	143	146
7,000	149	152	155	158	161	165	168	171	174	178
8,000	181	185	188	191	195	198	202	205	209	213
9,000	216	220	224	227	231	235	239	243	246	250
10,000	254	258	262	266	270	274	278	282	287	291
11,000	295	299	303	308	312	316	321	325	330	334
12,000	338	343	348	352	357	361	366	371	375	380
13,000	385	390	394	399	404	409	414	419	424	429
14,000	434	439	444	449	454	459	465	470	475	480
15,000	486	491	496	502	507	513	518	524	529	535
16,000	540	546	552	557	563	569	575	580	586	592
17,000	598	604	610	616	622	628	634	640	646	652
18,000	658	664	670	677	683	689	696	702	708	715
19,000	721	728	734	741	747	754	760	767	773	780
20,000	787	794	800	807	814	821	828	835	842	848
21,000	855	862	869	877	884	891	898	905	912	920
22,000	927	934	941	949	956	964	971	978	986	993
23,000	1,001	1,009	1,016	1,024	1,031	1,039	1,047	1,055	1,062	1,070
24,000	1,078	1,086	1,094	1,102	1,109	1,117	1,125	1,133	1,141	1,150
25,000	1,158	1,166	1,174	1,182	1,190	1,199	1,207	1,215	1,223	1,232

TABLE 2—RECOMMENDED CUTOFF LENGTHS

Derrick height, ft.	66 and less	67 to 90	91 to 110	111 to 132	133 to 140	141 to 160	160 and up
Approx. cut, ft.	34 to 40	50 to 60	60 to 70	70 to 80	75 to 85	90 to 100	110 to 120
Drum diam., in.:							
11	12	..	..	..	..	..	..
13	10	16	18	..	..	..	..
14	..	14	17	..	Drum laps		
16	..	12	15	17	..	..	..
18	..	11	13	15	..	..	..
20	..	..	12	14	15	..	..
22	..	..	11	12	13	..	..
24	Drum laps		9	11	12	14	..
26	..	..	9	10	11	13	..
28	..	..	8	10	11	13	15
30	..	..	..	9	10	12	14
32	..	..	..	9	9	11	13
34	..	..	..	..	..	..	13
36	..	..	..	..	..	..	12

To insure a change of the point of drum crossover, where wear and crushing is very severe, either one-half or one-fourth lap should be added to the number of laps listed above. As explained, the one-fourth or one-half lap addition is dependent on the type grooving on the drum.

from the crossover by cutting off a length depending on the drum diameter, equal to some number of laps plus one-fourth or one-half lap. The addition of one-fourth or one-half lap depends on the type of drum grooving used and is used to make sure that the point of drum crossover is changed when cutting.

One-half lap is most suitable on all drums not using counterbalance grooving. A counterbalance grooving system has the second layer crossing the first layer at two points 180° apart on a complete 360°. Thus, a one-half lap addition only moves one crossover point to another, while a one-fourth lap addition moves the crossover point a maximum distance with each cut.

Drum diameter of the draw works varies according to model and manufacturer. Table 2 shows the proper length to cut in terms of drum diameter.

Points of critical wear. The load is heaviest on the wire rope when removing the slips "going in" or "coming out" of the hole. The relative position of the wire rope with respect to the traveling and crown block sheaves in the up and down position is always the same if neither end of the wire rope is moved. Consequently, wear is severe at the point where the rope is in contact with the sheaves when a sudden pipe load is applied to the system. These points are referred to as "points of critical wear."

By pulling through and cutting off the rotary line at the drum end, these points of severe wear are moved. However, the wire rope must not be moved a distance which would place one point of critical wear in another position of critical wear. Rope in contact with the traveling and crown sheaves at pickup should be moved into the clear area by cutting the correct length. By doing this, wear will be more uniformly distributed throughout the length and not accumulated in one spot, causing a long cut.

The cutoff recommendations (calculated by laying out the reeving system graphically) in Table No. 2 are in terms of number of laps on the drum. Both the up and down positions are considered. The points of critical wear depend on the height of the derrick since distance from the center line of the traveling block to the center line of the crown block is directly related to the height of derrick. The difference between this distance in the up and down position is dependent on the length of the drill stand, double, triple, or quadruple.

Table 2 gives the approximate length to cut for a good cutoff program.

Service Between Cuts

We have explained the proper length to cut. To complete a good cutoff program we must find the proper **time** to cut. The basic idea is to establish the rate that the wire rope will be moving through the system. If the rate is too fast, then the accumulated wear on the line is not sufficient to actually wear out the line. If the rate is too slow, our visual inspection will often force us to make longer cuts than we planned. Result is less total work from the line.

TABLE 3—TON-MILES BETWEEN CUTS FOR EACH FOOT OF ROPE CUT (SERVICE FACTOR 5)

Size rope, in.	Ton-miles/ ft.
1	8
1⅛	12
1¼	16
1⅜	20
1½	24

Example: From Table 2, for 136-ft. derrick using 1¼-in. rope and a 24-in. drum, the proper cut length is 12½ laps or 79 ft. The number of ton-miles between cuts would be 79 × **16** (Table 3) or approximately 1,260 ton-miles.

We must first see how to measure the work accomplished by the line. We can't measure work by the number of wells drilled since each well has different drilling conditions. So, we must consider the different operations performed (drilling, coring, fishing, setting casing, etc.). In practice all we can consider is the work done by the line in raising and lowering the loads, in making round trips and in the operations of drilling, coring, and setting casing.

In each of these operations, the line is moving a load a distance. Therefore, we can measure the work in foot-pounds or, more practical, in ton-miles. By keeping records of the work on a line in ton-miles, we can determine a proper time interval between cuts.

In actual operation, no two rigs wear a wire rope rotary line exactly the same. This is because many factors differ, such as hole size, condition and type of equipment, operators, etc. Therefore, to properly start a systematic cutoff program, we need actual data on the specific rig. Maximum service on one particular rig cannot be expected to be exactly the same as on another similar rig. We recommend Table 3 as a starting point to be followed by a maximum service cutoff program.

Table 3 is set up with values for minimum service and should be within most rigs' capabilities.

Graphic method. The object of a cutoff procedure is to move the line through the system at a rate which allows the rope to be removed from the system prior to its breaking and to prevent recurring wear points. Failure to do either will cause a long cut. In other words, visual examination will show wear of the line that necessitates cutting more rope

TABLE 4—ONE-HALF EXCESS WEIGHT OF DRILL COLLARS, LB.

4½-in. drill pipe, 16.6-lb./ft. weight; drilling fluid, 75-lb./cu. ft. mud.

No. collar	Collar length, ft.	5¾ by 2¼ 6 by 2⅜ 74.9 lb./ft.	6 by 2¼ 6¼ by 2⅜ 82.9 lb./ft.	6¼ by 2¼ 6½ by 2⅜ 91.2 lb./ft.	6½ by 2¼ 6¾ by 2⅜ 99.9 lb./ft.	6¾ by 2¼ 7 by 2⅜ 108.7 lb./ft.	7¼ by 2⅜ 119.2 lb./ft.
1	30	700	800	900	1,000	1,200	1,300
2	60	1,500	1,700	1,900	2,100	2,300	2,600
3	90	2,200	2,500	2,800	3,100	3,500	3,900
4	120	2,900	3,300	3,800	4,200	4,600	5,200
5	150	3,700	4,200	4,700	5,200	5,800	6,500
6	180	4,400	5,000	5,600	6,300	7,000	7,800
7	210	5,100	5,800	6,600	7,300	8,100	9,100
8	240	5,900	6,700	7,500	8,400	9,300	10,400
9	240	6,600	7,500	8,500	9,400	10,400	11,700
10	300	7,300	8,300	9,400	10,500	11,600	13,000
11	330	8,100	9,200	10,300	11,500	12,800	14,300
12	360	8,800	10,000	11,300	12,600	13,900	15,600
13	390	9,500	10,800	12,200	13,600	15,100	16,900
14	420	10,200	11,700	13,200	14,700	16,200	18,200
15	450	11,000	12,500	14,100	15,700	17,400	19,500
16	480	11,700	13,300	15,000	16,800	18,600	20,800
17	510	12,400	14,200	16,000	17,800	19,700	22,100
18	540	13,200	15,000	16,900	18,900	20,900	23,400
19	570	13,900	15,800	17,900	19,900	22,000	24,700
20	600	14,600	16,700	18,800	21,000	23,200	26,000
21	630	15,400	17,500	19,800	22,000	24,300	27,200
22	660	16,100	18,300	20,700	23,100	25,500	28,500
23	690	16,800	19,200	21,600	24,100	26,700	29,800
24	720	17,600	20,000	22,600	25,200	27,800	31,100
25	750	18,300	20,900	23,500	26,200	29,000	32,400
26	780	19,000	21,700	24,500	27,300	30,100	33,700
27	810	19,800	22,500	25,400	28,300	31,300	35,000
28	840	20,500	23,400	26,300	29,400	32,500	36,300
29	870	21,200	24,200	27,300	30,400	33,600	37,600
30	900	22,000	25,000	28,200	31,500	34,800	38,900
31	930	22,700	25,900	29,200	32,500	35,900	40,200
32	960	23,400	26,700	30,100	33,600	37,100	41,500
33	990	24,200	27,500	31,000	34,600	38,300	42,800
34	1,020	24,900	28,400	32,000	35,600	39,400	44,100
35	1,050	25,600	29,200	32,900	36,700	40,600	45,400
36	1,080	26,400	30,000	33,900	37,700	41,700	46,700
37	1,110	27,100	30,900	34,800	38,800	42,900	48,000
38	1,140	27,800	31,700	35,700	39,800	44,100	49,300
39	1,170	28,500	32,500	36,700	40,900	45,200	50,600
40	1,200	29,300	33,400	37,600	41,900	46,400	51,900

than planned. **It must be remembered that in all cases, visual inspection of the wire rope by the operator must take precedence over any predetermined calculations.**

A good procedure is to make a graph of accumulated ton-miles versus accumulated feet cut. Fig. 1 is an example.

Say we have a 1¼-in. standard rotary line on a 136-ft. derrick, stringing eight lines. This gives 830 ft. between the fast sheave and the dead sheave in the down position. We have found that the proper length to cut is 79 ft. or 12½ laps on a 24-in. drum (Table 2). Table 3 shows that a cut should come every 1,260 ton-miles. This 1,260 ton-miles is only a start.

We should check to be sure that the rate is not too fast. We then cut on the 1,260 ton-miles until at least 830 ft. has passed through the reeving system. The plan is followed and 11 cuts (11 by 79 ft. = 869 ft.) are made at 1,260 ton-miles. We haven't found it necessary to make a long cut. Line A in Fig. 1 shows this. The rope is worn, but no broken wires are showing in the cut sections.

It might be possible to safely put more wear on the rope between cuts, so let us increase from 16 ton-miles per foot to 18 ton-miles per foot cut. Now, 79 ft. or 12½ laps are cut at 1,420 ton-miles (79 × 18 = 1,420, approximately). After 11 more cuts and another 869 ft. have passed through the reeving system, the rope at the cuts is still intact with no broken wires. This is shown by Line B in Fig. 1.

Once again the rate has been established. However, when the expected service is raised to 20 ton-miles per foot cut, or 1,580 ton-miles (79 × 20 = 1,580), we discover a worn spot with broken wires after five cuts. (See "offset" in Line C, Fig. 1.) We must make a 300-ft. cut to remove it from the system. This means there were too many ton-miles between cuts. Therefore, the maximum service has been surpassed and the rate should be dropped back to 18 ton-miles per foot cut. We have reached the maximum service for the rig. As you can see, this process takes time, but it continually works toward maximum service.

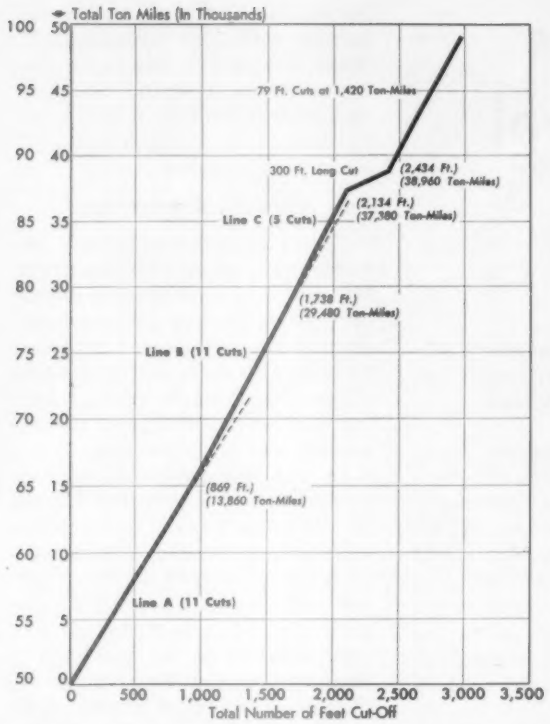
Service factor. The previous figures were based on operating under a "service factor" of five at all times. Wire rope wears at different rates in different services. That is, we expect more service when operating light, and less service when heavy.

In the past, many have used a quite involved method of determining service factor. It used mathematical calculations or charts to find lead-line pull. With Fig. 2, we can find lead-line pull, service factor, and per cent service expected quite simply.

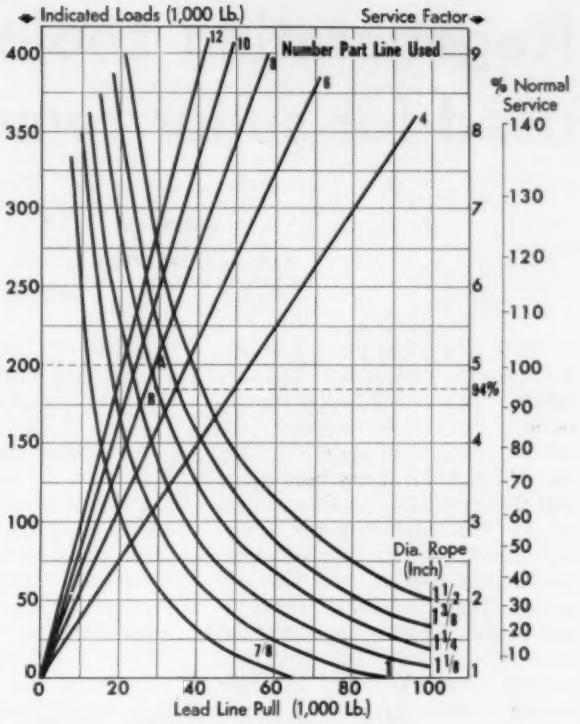
As an example of Fig. 2, assume we have an eight-part 1¼-in. standard rotary line and 200,000 lb. weight of load. First, we locate 200,000 lb. on the vertical scale and proceed horizontally to intersect the eight-part reeving line (Intersection A). We can read the lead line pull of 29,400 lb. off the horizontal scale. From the Intersection A, we proceed vertically to intersect the correct size rope curve (Intersection B). Then we proceed horizontally to the service factor and per cent normal service scales. Service factor is 4.7 of 94%.

From this graph, we can find a flexible service goal dependent on the actual load. Many rigs now use what might be referred to as a variable service goal. When working shallow, a higher ton-mile/foot cut figure is used. As the depth increases, this figure decreases. In effect, the rope is used more when operating at high service factors. Fig. 2 makes this variable service goal quite easy and helps increase rope service.

Slipping. In many fields, drillers make a practice of "slipping" the line along with the cutting practice. This practice has been most successful in areas of hard drilling and excess vibration, along with offset drilling. To slip a rotary line lets



DEVELOPING BEST CUTOFF program is a matter of starting with a ton-mile basis you can expect to fulfill (Line A), then extending the ton-miles slightly (Line B). In this case, extending the ton-mile limit (Line C) farther resulted in a long cut that wasted good rope. So, program was dropped back to same basis as Line B. Fig. 1.



THREE DIFFERENT VALUES may be obtained from these curves of "expected service" from drilling line. Knowing the indicated load (vertical axis), the diameter of the drilling line, and the number of lines strung will enable finding the service factor, per cent of normal service, and the lead-line pull. Fig. 2.

more rope enter the system and buildup on the drum. Therefore, good drum spooling is a "must" for a successful slip-cut program. When slipping, the points of primary wear are moved within the system, but the points of drum crossover are not altered until the cut.

To slip, along with cutting, we recommend the following method. Say we have figured a program of cutting 79 ft. or 12½ drum laps at 1,580 ton-miles. We decide to slip between cuts three times. Both the distance (79 ft.) and ton-miles (1,580 ton-miles ÷ 4 = 395 ton-miles). The slip program would be, slip 20 ft. each 395 ton-miles. Do this three times, followed by a 79-ft. cut on 1,580 accumulated ton-miles.

If we want to slip only twice between cuts, the divisor will be three.

With this method, the crossover points of wear are moved correctly and the points of primary wear in the traveling and crown blocks are changed more frequently.

Keeping Account of Service

The different operations that accumulate service on the rotary line and can be successfully figured are: (1) round trips, (2) drilling, (3) coring, and (4) setting casing.

Round trips. By using Table 4, we can find the excess weight due to drill collars. For the total excess weight, this figure is added to the weight of the traveling block, hook, links, and elevator. Knowing total excess weight, we refer to the correct ton-mile tables to find the exact ton-miles accumulated for one round trip.

Tables 1 and 4 are two of the 462 ton-mile tables which can be used on a specific drilling situation.

Example:

Depth	15,400 ft.
Drill pipe	4½-in. (16.6 lb./ft.)
Drill collars	23, 6 by 2¼-in.
Drilling fluid	Mud
Weight of traveling block, hook, links, and elevator	11,000 lb.

From Table 4 we find the excess weight due to the drill collars to be 19,200 lb. This is added to the weight of traveling block, hook, links, and elevator to give a total excess weight of 30,200 lb. (19,200 + 11,000 lb. = 30,200 lb). Table 1 is for 4½-in. by 16.6 lb./ft. drill pipe; 75-lb. mud, and 30,000 lb. excess weight. When we refer to the proper depth of 15,400 ft., we see the ton-miles accumulated during one round trip to be 507.

Drilling. The ton-mile service in drilling equals **three times** the difference between the ton-miles for one round trip from the depth at which drilling started. Use Tables 1 and 4.

Coring. The ton-mile service in coring equals **two times** the difference in the ton-miles for one round trip from the depth at which coring stopped and the ton-miles for one round trip from the depth at which coring started. Use Tables 1 and 4.

Setting casing. The ton-mile service insetting casing would be one-half the ton-miles accumulated in making a round trip if the effective weight of the casing were the same as the effective weight of the drill pipe.

Regenerating zeolites used for sulfur removal

BY HARRY W. HAINES, JR.
Haines Gas Technologists, Ltd.
G. A. WIELINGEN
J. C. Sproule & Associates, Ltd.
AND F. B. MATHEWS
Maloney-Crawford Tank & Service Co., Ltd.

A NEW adsorption process for desulfurization and sulfur recovery which employs alkali-metal aluminosilicates is being developed in Canada for commercial use (OGJ, Dec. 26, '60, p. 165). It has been found that these synthetic zeolites are excellent Claus catalysts and have high equilibrium capacities for water vapor, carbon dioxide, and hydrogen sulfide. These properties permit simultaneous dehydration and sweetening of natural gas, and direct conversion of the adsorbed hydrogen sulfide to elemental sulfur.

The Haines process, as it is known, is similar to those used in short-cycle hydrocarbon-recovery units, but uses a totally new type of regeneration cycle. It does not use sweet natural gas as a thermal source for regeneration of the adsorbent. Instead, the process may employ sulfur-burner gases containing sulfur dioxide, for the production of sulfur vapor; or oxygen-containing gases for production of SO_2.

A thermodynamic analysis of this process is presented in this article to show the feasibility of catalytic regeneration with air, sulfur-burner gases containing 100% excess air, sulfur-burner gases containing 3% oxygen, and dilute air burnoff (inert gases containing oxygen).

Presented at the 1961 Gas Conditioning Conference, University of Oklahoma, Norman.

Adsorbtion characteristics. Static isobars for the adsorption of hydrogen sulfide on calcium aluminosilicates, using fresh charges of adsorbent, are shown in Fig. 1. At reasonable hydrogen sulfide partial pressures, dynamic loadings in the range of 25 to 75 std. cu. ft. per 100 lb. may easily be attained. A commercial unit, however, must always be designed to allow for coadsorption of water vapor and carbon dioxide.

Temperature rise during adsorption of hydrogen sulfide, as shown in Fig. 2, can be deceptive since the heat of wetting is almost twice the latent heat of condensation. This chart clearly indicates that temperature rises of 100° F. or more can occur in adsorption towers treating high-strength gases.

Both graphs are important design tools. They immediately reveal the type of regeneration scheme that may be employed without overheating the adsorbent, when used in conjunction with other thermodynamic charts presented in this paper. Fig. 2 also serves as an indirect check on adsorbate loadings if heat-transfer fronts are being traced with thermocouple probes.

Catalytic Regeneration

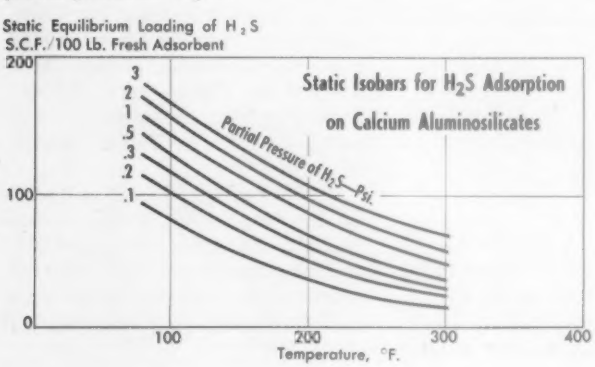
During regeneration a very important question must be considered: Will the heat evolved from chemical reaction burn up the adsorbent? Appropriate answers can be found by examining the reactions involved at specific adsorbate loadings, taking into consideration that the adsorbent acts as a heat sink.

In our thermodynamic analysis of the system, we prepared a series of "temperature rise" charts, calculated by assuming zero temperature difference between the adsorbent and mean gas-phase temperatures. This is only a first approximation of the heat effects, since local or skin temperatures on the surface of a pellet lie somewhere between the average adsorbent temperature and the flame temperature of the gas-phase reaction. A reasonably accurate estimate of skin temperatures may be obtained by trial-and-error calculations with an assumed volumetric heat transfer coefficient of 5,000 B.t.u./hr./cu. ft./°F.

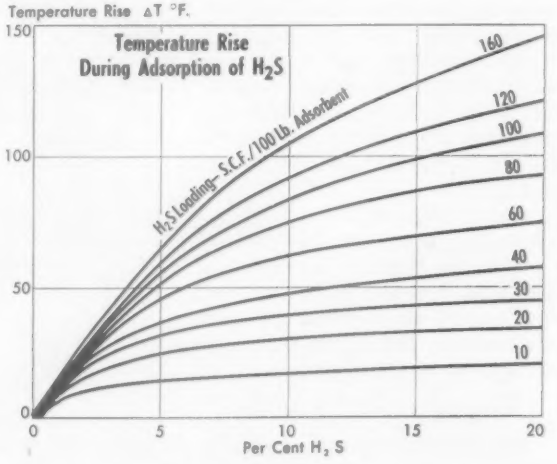
Heat effects of the nine different reaction conditions given in the accompanying table are required to define the system for:

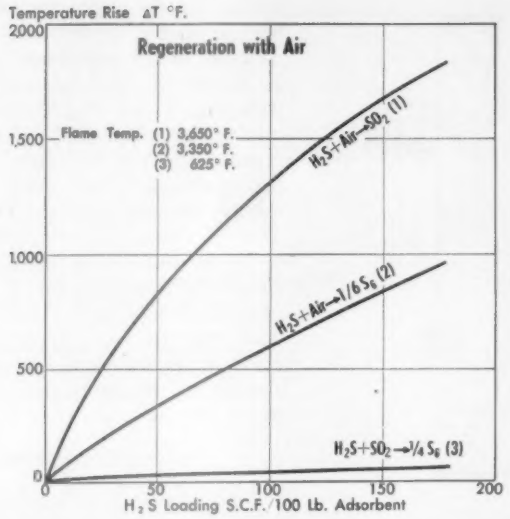
- Temperature rise during regeneration with air.

DYNAMIC LOADINGS in the range of 25 to 75 std. cu. ft. per 100 lb. may easily be obtained at reasonable hydrogen sulfide partial pressures. Fig. 1.

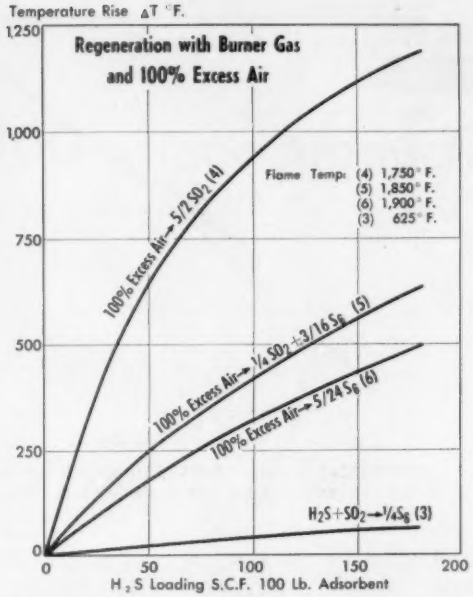


TEMPERATURE RISES of 100° F. or more can occur in adsorption towers treating gases with high hydrogen sulfide concentrations. Fig. 2.





TOTAL OXIDATION of hydrogen sulfide, at adsorbate loadings below 50 std. cu. ft. per 100 lb., does not cause excessive overheating. Fig. 3.


Temperature Rise ΔT °F.
Regeneration with Burner Gas and 100% Excess Air
Flame Temp: (4) 1,750° F.
(5) 1,850° F.
(6) 1,900° F.
(3) 625° F.
100% Excess Air→5/7 SO₂ (4)
100% Excess Air→¼ SO₂+3/16 S₆ (5)
100% Excess Air→5/24 S₆ (6)
H₂S+SO₂→¼S₆ (3)
H₂S Loading S.C.F. 100 Lb. Adsorbent

REGENERATION TEMPERATURES above the sulfur dew point, particularly at low adsorbate loadings, sometimes require 100% excess air. Fig. 4.

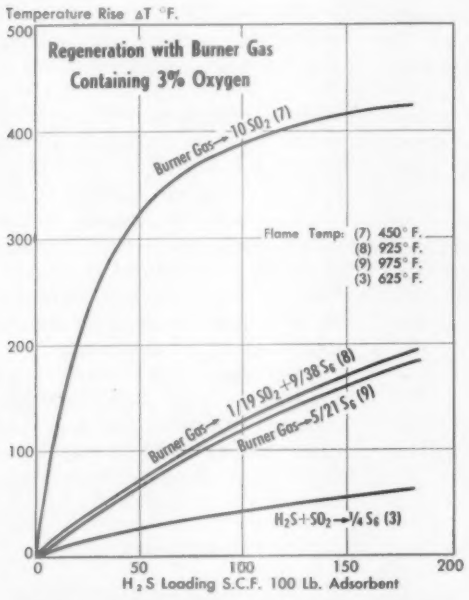
• Temperature rise during regeneration with sulfur-burner gas and 100% excess air.

• Temperature rise during regeneration with sulfur-burner gas containing 18% sulfur dioxide.

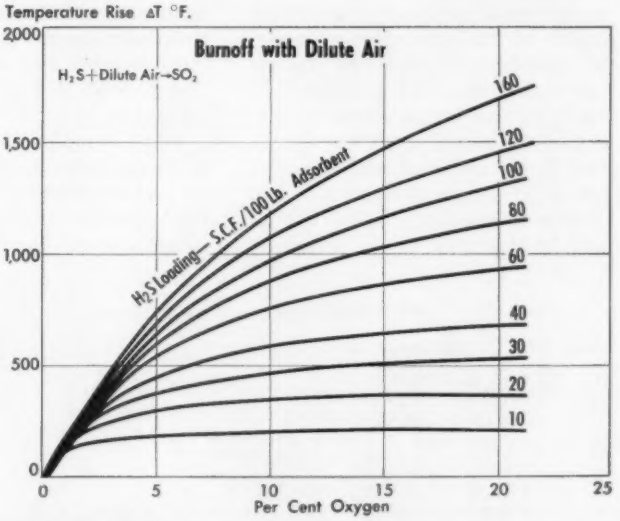
Air burnoff. Certain types of alkali-metal aluminosilicates will initiate hydrogen sulfide combustion at ambient temperatures, whereas others require preheat temperatures of 300° F. Therefore, regenerating a loaded adsorbent bed solely with air is economically desirable in situations where sour gases contain small concentrations of hydrogen sulfide.

We visualize, for example, the development of a "sour-gas dehydrator" requiring no external energy source for regeneration, when small amounts of sulfur dioxide emission can be tolerated. As shown in Fig. 3, excessive overheating does not occur at adsorbate loadings below 50 std. cu. ft. per 100 lb. during total oxidation of hydrogen sulfide (Reaction I).

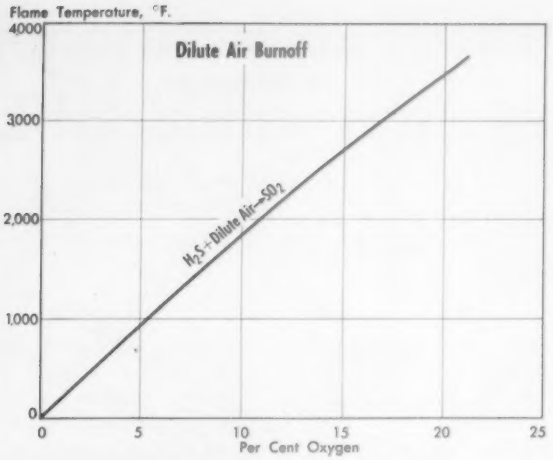
If the relative speeds of the heat and mass-transfer fronts can be controlled properly to promote partial oxidation of hydrogen sulfide, as illustrated in Fig. 3, thermal destruction of the adsorbent is highly improbable at all levels of adsorbate


Temperature Rise ΔT °F.
Regeneration with Burner Gas Containing 3% Oxygen
Flame Temp: (7) 450° F.
(8) 925° F.
(9) 975° F.
(3) 625° F.
Burner Gas→10 SO₂ (7)
Burner Gas→1/19 SO₂+9/38 S₆ (8)
Burner Gas→5/21 S₆ (9)
H₂S+SO₂→¼ S₆ (3)
H₂S Loading S.C.F. 100 Lb. Adsorbent

BURNER-GAS REGENERATION develops lower flame temperatures than air or excess air regeneration. Fig. 5.



DILUTE AIR BURNOFF can be used when sulfur-burner gases aren't available or when adsorbate loading is too high to permit air burnoff. Fig. 6.



THEORETICAL FLAME TEMPERATURES should be considered when regenerating by dilute air burnoff. Fig. 7.

loading (Reaction 2). By comparison, sulfur dioxide regeneration produces a nominal temperature rise (Reaction 3) and a very low flame temperature.

Burner-gas regeneration. Sulfur-burner gases, as illustrated in Fig. 4, can be introduced into the regeneration tower at 475° F. to maintain a maximum theoretical flame temperature of 1,100° F. (Reaction 3). Fig. 4 shows heat effects at the "halfway" point between air burnoff and sulfur dioxide regeneration.

Under certain circumstances 100% excess air may be required in the burner gas to produce regeneration temperatures above the sulfur dew point, particularly at low adsorbate loadings. Again, the relative speeds of the heat and mass-transfer fronts are important factors which determine the conditions of total hydrogen sulfide oxidation (Reaction 4), partial oxidation (Reaction 6), or combined reactions (Reaction 5). Areas of relatively safe operation, however, can be determined in each case.

At the other extreme, we must also consider regeneration with sulfur-burner gases containing a practical minimum of oxygen concentration, as shown in Fig. 5.

The conditions of total oxidation (Reaction 7), partial oxidation (Reaction 9), and the combined reaction (Reaction 8) have been investigated. "Pure" burner-gas regeneration, as one might expect, develops lower flame temperatures than air regeneration or excess air regeneration.

Dilute air burnoff. Certain situations arise wherein the daily volume of sulfur production falls below the minimum required to sustain operation of a liquid sulfur burner. In addition, the adsorbate loading may be too great to permit air burnoff with any degree of safety. There circumstances lead to a consideration of dilute air burnoff (inert gases containing oxygen).

Our experiments to date have not produced the conditions required for partial oxidation, therefore, only total oxidation is examined thermodynamically in Fig. 6. This graph is similar to the type computed for burning carbon deposits on cracking catalysts in the petroleum industry. It should be used in conjunction with Fig. 1 and Fig. 2 for determining the safe limits under which regeneration can be started at the end of the adsorption cycle. (These criteria also apply to Figs. 3 through 5).

As an added precaution, Fig. 7 should be consulted for a reading of theoretical flame temperature. And both procedures must be checked against a trial-and-error estimate of maximum local pellet temperatures.

REGENERATION REACTIONS

No.	Reaction (at 60° F. & 1 atm.)*	ΔH(B.t.u./s.c.f. H_2S)
1	$H_2S+3/2O_2=SO_2+H_2O$	−588
2	$H_2S+1/2O_2=1/6S_6+H_2O$	−232
3	$H_2S+1/2SO_2=1/4S_6+H_2O$	− 53.5
4	$H_2S+3/2O_2+3/2SO_2=5/2SO_2+H_2O$	−588
5	$H_2S+3/8O_2=1/4SO_2+3/16S_6+H_2O$	−187
6	$H_2S+1/4O_2+1/4SO_2=5/24S_6+H_2O$	−142.8
7	$H_2S+3/2O_2+9\ SO_2=10\ SO_2+H_2O$	−588
8	$H_2S+3/38O_2+9/19\ SO_2=1/19\ SO_2+9/38\ S_6+H_2O$	− 81.7
9	$H_2S+1/14O_2+3/7\ SO_2=5/21\ S_6+H_2O$	− 79

*Reactants and products in the gas phase.

Process Description

Our process may be applied in two, three, and four-tower units similar to conventional C_5+ hydrocarbon-recovery plants. When high-pressure gases are treated, a depressurization and repressurization cycle must be incorporated in the system, in addition to adsorption, catalytic regeneration, and cooling steps. This method of operation avoids the use of imbedded heating coils for regeneration, or excessive loss of sweet gas normally required for thermal regeneration.

A pilot-plant flow sheet, material and energy balance, and basic design have been described in an earlier paper.[1] This unit will be operated in Canada by Maloney-Crawford Tank & Service Co., Ltd. to determine the economics of adsorbent life.

Conclusion

The regeneration schemes described may be employed for dehydration and desulfurization; or for dehydration, desulfurization, and sulfur recovery. In all cases, operating conditions can be found wherein adsorbent temperatures do not exceed 1,100° F., which is considered the maximum for avoiding thermal destruction of the adsorbent.

Adsorbent life is being investigated in the pilot plant mentioned above to determine the degree of water and/or acid damage that might occur at operating temperatures of 500° to 1,000° F.

Reference

1. Haines, H. W., Jr., Van Wielingen, G. A. and Palmer, G. H., "Sulfur Recovery With Synthetic Zeolites": Forty-fourth national AIChE meeting, New Orleans.

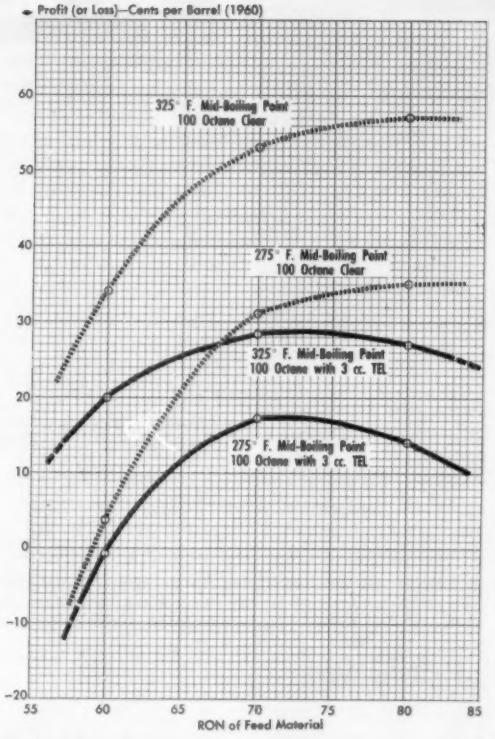
BY W. L. NELSON, Technical Editor and Petroleum Consultant

Questions on TECHNOLOGY

Is reforming feasible for 100-octane production?

Your answer of Feb. 13, 1961, regarding reforming to make 100-octane is just fine, but what about the cost? Some refiners are in doubt about the feasibility of catalytic reforming.

Cost is obviously a vital consideration. To reform very low octane gasolines (below about 60) to 100-octane gasoline is not economically feasible because of the following factors: (1) the loss to gases and gaseous hydrocarbons is large, (2) the operating cost is relatively high, and (3) the value of a 40-octane naphtha to a refiner is not much less than the value of a 60 or 70-octane naphtha. Thus, if reforming is to be profitable one must (1) make a large yield, that is, use a high-octane feed stock, (2) use a high-boiling feed such as one which has a mid-boiling point of 300° F. or even 340° F., and (3) work in a range of feed and product octane number in which the difference in value of the feed and the product is great. Feed octane numbers of 60 or higher meet these requirements and the degree of profitability is evident in Fig. 1. Such feeds are usually ones that have been produced by thermal reforming, thermal cracking, or catalytic cracking, although occasionally highly naphthenic straightrun feed naphtha is encountered.



PROFIT (or loss) when reforming to 100-octane gasoline. Fig. 1.

Fig. 1 appears to indicate that reforming of low-octane feeds is not economical but this is only true when producing very high octane products. If the reformate is to have an octane number of only 85-95, then the reforming of low-octane naphthas becomes profitable provided the yields are reasonably large (over about 85% pentane plus).

The operating costs used in developing Fig. 1 are shown in Table 1. Note that several costs not always included in operating costs are used in Table 1, and thus the profits of Fig. 1 are lower than those suggested by some technologists.

As a credit in the operations is the greater value of the 100-octane product. Unleaded gasoline or naphtha values taken from the Questions on Technology page of December 19, 1960 (p. 102) are tabulated below. They are based on average Gulf cargo prices as of August 15, 1960.

RON	Cents/gal.
100	14.7
90	*11.5
80	10.2
70	9.6
60	9.4
50	*9.2
40	*9.1

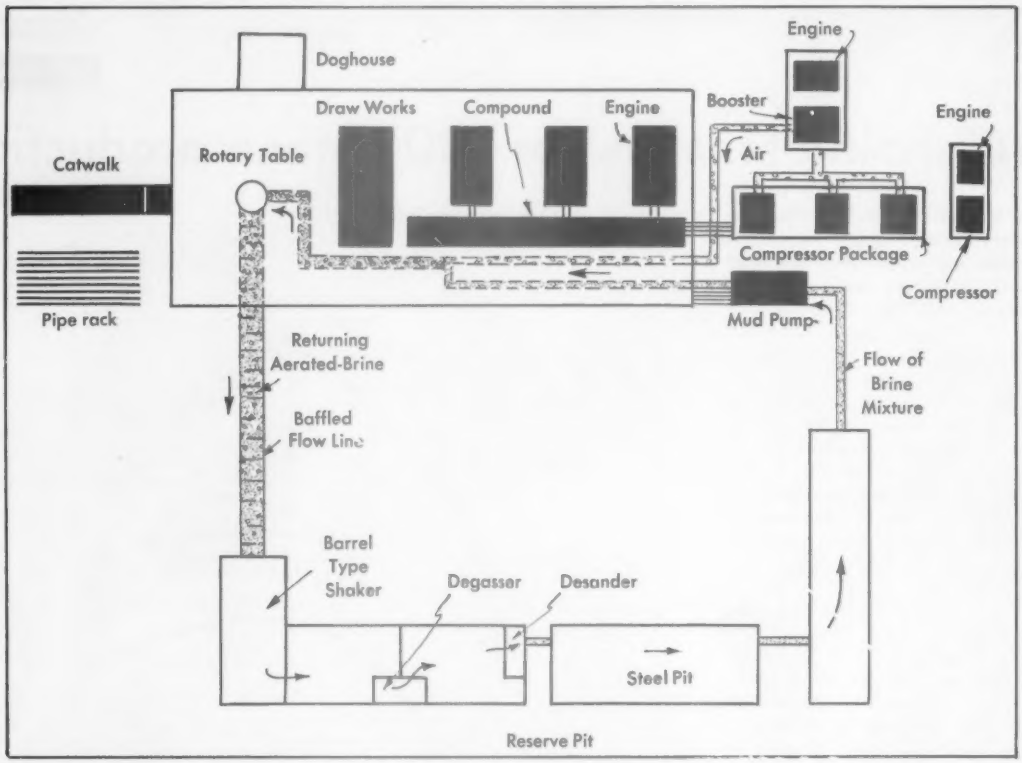
*Not involved in computations.

These prices are different from those received by any single refinery but corrections can be applied. However, the general pattern indicated in Fig. 1 should be valid. Finally, some refiners have a large market for 100-octane premium gasoline whereas others can sell little premium material, and such influences may result in values that vary greatly from the values tabulated above.

TABLE 1—OPERATING COSTS AND EXPENSES OF CATALYTIC REFORMING AS A FUNCTION OF YIELD OF PENTANE-PLUS REFORMATES— CENTS PER BARREL FEED

	75% Yield	80% Yield	85% Yield	90% Yield	95% Yield
Feed preparation*	0.5-3.0	0.5-3.0	0.5-3.0	0.5-3.0	0.5-3.0
Catalytic reforming	31-36	30-34	28-32	26-30	24-28
Catalyst	9	8	7	6	5
Hydrogen treating		0-8	0-8	6-8	6-8
Lab., royalty, obs., etc.	14	14-17	14-17	17	17
Total 1956 operating cost	58.0	61.0	58.0	59.0	57.0
Total 1960 operating cost†	62.5	66.0	63.0	63.5	61.5
Degrading to C_3 and C_4‡	40	37	33	27	16
Total expenses	102.5	103.0	96	90.5	77.5

*Lowest value for feed preparation in topping and highest value for an atmospheric rerun operation. †Using Nelson Operating Cost Index, The Oil and Gas Journal, first issue each month. ‡Propane at 3 cents per gallon, butane at 7 cents per gallon (no credit for fuel gases).



AERATED BRINE was used by Delta rig on deep, small-diameter New Mexico well. Mud pump put into hole 300 g.p.m. of a mixture of brine, lime, soap, and corrosion inhibitor. Compressors injected into standpipe 1,500 c.f.m. of air. Result was an aerated fluid calcu'ated to weigh less than 1 lb. per gal.

How Delta drills with

Air-foam aerated fluid in West Texas

Delta Drilling Co. has a reputation for leadership among drilling contractors in developing new techniques. Air drilling is a good example of this leadership. Probably the most publicized air drilling by Delta has been in the hard rocks of the Appalachian area. The company has contributed greatly there toward making rotary drilling cheaper than cable-tool drilling for the first time in history. The firm now operates nine rigs, all fully equipped for air drilling, out of its Pittsburgh office.

Less publicized but equally impressive is the work done by Delta's West Texas division, operating out of Odessa. So, we asked the company to tell about its progress toward putting air, foam, and aerated-fluid drilling on a definitely economical basis in that area.

BY ROBERT WILLBORN
Engineer, Delta Drilling Co., Odessa, Tex.

FROM the contractor's point of view, the important thing about air drilling is that you can make hole twice, or even three times as fast as with mud drilling. And, with air drilling and its offsprings, foam and aerated-fluid drilling, you can drill zones which are difficult or impossible to drill with mud.

Drilling men have proved these facts to themselves over the past 3 years, and now only the very outstanding performances draw much attention. We feel that Delta Drilling Co. has turned in its share of these outstanding jobs. For instance, recently, we have:

1. Drilled a well with air to 10,540 ft. with eight bits in 371 rotating hours. One of the bits made 3,795 ft. in 121 rotating hours.
2. Foam-drilled a water zone which produced a full 7-in. stream of fluid at the surface.
3. Drilled a 7⅞-in. hole to 8,968 ft. using aerated brine as the circulating fluid.

To date, Delta's West Texas division has made a total of 53,095 ft. of air-drilled hole. This was done in only 2,528 hours of total rotating time.

Equipment. Delta's compressor system in West Texas consists of four WBK Gardner - Denver compressors, each rated at 600 c.f.m. at 200 psi. Three of the compressors are skid-mounted into a package which is powered by a belt drive from the transmission of the rig. The fourth compressor is mounted on a separate skid along with an eight-cylinder gas - butane engine to furnish power.

This compressor system is capable of delivering 2,400 c.f.m. and may be used with a booster if so desired. The system may be used on any of Delta's six rigs in this district and all rigs have used it on at least one job.

Area of operations. A testing ground for Delta's air-drilling techniques has been Pecos County, Texas, in and around Puckett field where drilling is full of complex problems. We have used air on parts of four wells in the area with moderate success and make it a policy to drill with air whenever possible. We have also air-drilled in Crane and Crockett counties, Texas, and in Chaves and Eddy counties, New Mexico.

One of our more spectacular straight - air - drilling jobs was the Cities Service Oil Co. 1-B Henderson in Crockett County. This is the well we drilled to 10,540 ft. with eight bits and 371 rotating hours. The bit which made 3,795 ft. in 121 rotating hours was a 7⅞-in. carbide-insert type.

The well was drilled by Delta's Rig 4 and completed in November 1960. The hole was mudded up at 10,540 ft. and finished using another new development, a Gardner-Denver PO-7 plunger pump.

We have found that air drilling works quite well in the 17½ and 12¼-in. surface holes in West Texas. A large part of our straight-air drilling has been in such holes.

Of course, our straight-air drilling is limited to dry formations. Even a little water in the hole can cause balls and rings of cuttings to form on the bit and the drill collars. These accumulations can't be cleaned from the hole with air alone and the drill string can become stuck or drilling can be stopped.

This problem brought about our use of the foam-drilling technique.

Foam drilling. By injecting various amounts of sudsing agent into air lines we are able to reduce surface tension of the water and foam it out of the hole. As a foam, density of the fluid is lower so that it is easier to lift with the air system.

The foaming agent is mixed in a 550-gal. tank located adjacent to the air line to the well. We have found that by having a large volume of mixture on hand we can have a more homogeneous mixture and keep injection rate more nearly constant. The amount and concentration of foaming agent used varies with the amount of water encountered.

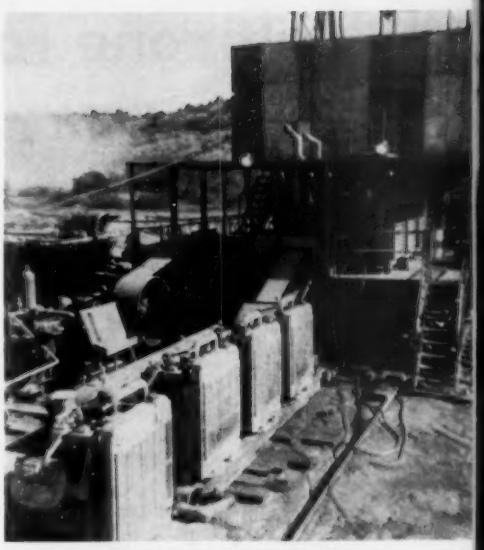
This practice proved successful in Pecos County, Texas, and on two different occasions on Cities Service wells in Crockett County, Texas. On the Gulf Oil Corp. 1 Caverns unit in Eddy County, New Mexico, Delta was able to handle a 7-in. stream of water by injecting from 60 to 80 bbl. of mixture per 8-hour tour. This was at a depth of about 1,200 ft.

We were warned of the buildup of water by an increase in air pressure. So we began injecting our foaming mixture with an air-injection pump. The air compressors were delivering about 2,500 c.f.m. during this time.

Aerated water. Another derivative of air drilling that has been used by Delta's West Texas division is aerated fluid drilling. We first tried this technique with our Rig 4 in Lea County, New Mexico, while drilling Gulf Oil Corp. Federal Littlefield "DP" Option No. 1. A mixture of lime, soap, and a corrosion inhibitor was injected into a brine-water base. Air was injected into the standpipe to form a homogeneous mixture through the annulus to lift cuttings. Drilling rate with this technique was about 85% of that with conventional air drilling.

The homogeneous air-water mixture weighed a little less than 1 lb. per gal. (calculated). To get this weight, we injected brine water at the rate of 300 g.p.m. and air at 1,500 c.f.m. The air was compressed through the usual compressor system and then fed into a booster which injected it into the hole.

This booster was lubricated with a nonhydrocarbon mixture since a mixture of air and lubricating oil is combustible at high temperatures and pressures.



FOUR COMPRESSORS used by Delta to put air into the mud are shown in left foreground. Nearest compressor is driven by its own engine. Other three are driven from rig compound.

The aerated fluid flowed from the annulus out of the wellhead and through a large flow line which had baffles welded in it. Purpose of the baffled line was to deaerate the brine water and damp out any heading or surging of the returning fluid. The fluid then flowed over a barrel-type shaker and returned to the pits as brine water. It was put through a degasser and desander and the process started again. Fig. 1 shows the flow pattern and circulation system.

The aerated fluid drilled the 7⅞-in. hole to final depth of 8,968 ft. The system we used on the job was satisfactory for these particular conditions. We feel that as we have an opportunity to do more such work we will be able to streamline and revamp our technique to suit almost all conditions.

Our drilling rates with foam and with aerated fluid are consistently greater than with mud but they are not always as great as with straight air. Foam or aerated fluid make a low-pressure drilling system just as does air. That is, the pressure in the hole at the bit is less than it would be with mud or plain water. Pressure at the bit using foam and aerated fluid is not so low as with air alone. Still, less weight and slower rotary speed can be used to drill faster than the mud.

Multizone rod pumping

OIL-WELL PUMPING
PART 42

BY JOSEPH ZABA

MULTIZONE COMPLETIONS, starting with duals, appeared in the late thirties. During World War II they were used as an expedient to conserve steel. However, even during the first few years after the war, acceptance was slow primarily because of the difficulties of artificial lifting of this type of completion without commingling the fluids. As pumping equipment became available, multizone completions began to be routine.

Dual-zone pump. First approach to dual pumping was the so-called dual-zone pump. Principle of operation is shown in Fig. 50-A. The subsurface portion of the first of this type consisted of two pumps installed in tandem operated by one string of rods. The lower-zone pump was operated by a suitably packed-off polished rod. Two packers were used to separate the two producing zones. Production from the lower zone was directed through a crossover into the annulus where it pumped to the surface.

Basic disadvantage of such an arrangement was lack of flexibility. Since both pumps had to be operated with the same length of stroke and the same speed of pumping, pump size was the only variable which could be changed to compensate for differences in productivities of the zones. Also, gas could not be vented from either of the two zones, frequently resulting in low volumetric efficiency. Paraffin removal from the annulus was a problem.

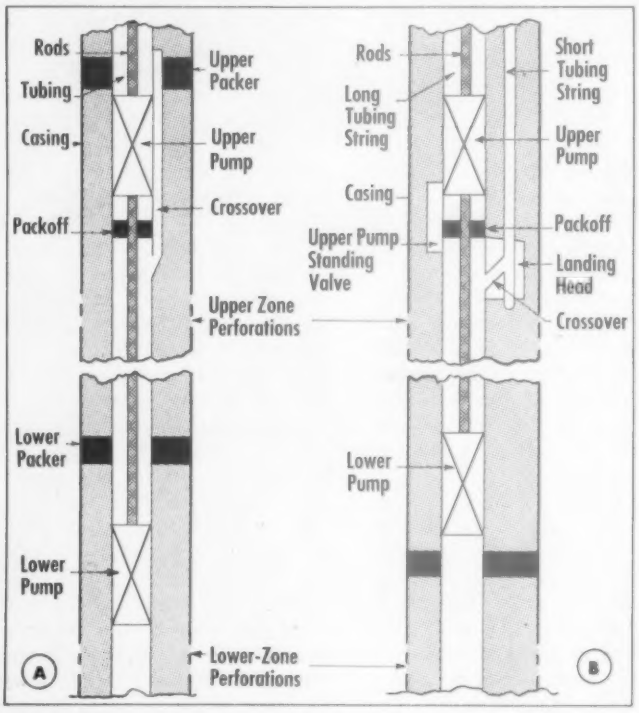
In some wells, the upper zones of which produced sand with the well fluid, sanding-up difficulties developed. Pumping-off of one of the zones imparted shock loads to the rod string, loaded by the other pump. This resulted in more rod breaks.

Most of these problems have been either solved or reduced in severity by improvements in the original subsurface system of this type of installation. The use of a second string of tubing for production of the lower zone eliminated the problem of paraffin in the annulus and permitted venting of the upper zone. Only one packer is used in this type, Fig. 50-B.

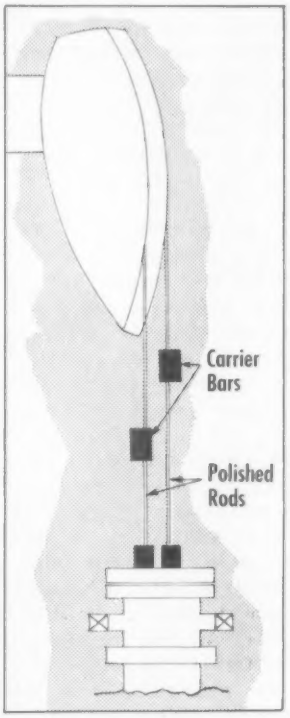
The pumps and the rods are installed in the long tubing string. The crossover from the lower pump ends in an integral landing head. The second, or short string, equipped on the bottom with a landing spear, is run separately and is landed and sealed off in the landing head. The problem of gas interference in the lower pump is approached in two ways.

Previously discussed pumps (Part 31) designed for handling gassy fluids are used, or a vent tubing string is provided for the lower zone. This may be an external string attached to the long tubing string or a concentric string run inside the lower-zone production tubing. The possible results of pumpoff conditions of one of the pumps must be considered at the time of selection of the well for this type of installation.

Lack of flexibility of a dual-zone pump has been, so far, only partially eliminated.[1] Production of the upper zone, if exceeding the allowable under the fixed pumping cycle, can be circulated back into the annulus, provided the well does not have a high shut-in pressure. For control of production of the lower zone a back-pressure valve for the lower pump is available which can be controlled from



DUAL-ZONE pump arrangement, A, with production through one string of tubing and the annulus had several disadvantages, including the inability to vent gas from either zone. A newer development uses two strings of tubing, B, and gas from the upper zone can be vented. Fig. 50.



DUAL-HORSEHEAD arrangement for simultaneous pumping of two zones with two sets of rods, and two pumps. Fig. 51.

EARLY DUAL COMPLETION using two pumping units was made with one unit elevated to prevent interference between the carrier bars. New equipment has been designed with enough clearance so that this is no longer a problem. Fig. 52.

the surface. When the tubing of the lower zone is closed in, the valve opens on the upstroke permitting oil to bypass the plunger. This is a relatively new development still subject to improvement.

The first installation of a triple-zone pump, with the bottom zone at around 3,200 ft. was made in January 1959.[2] The upper and middle pumps are built as a unit and are connected by a packed-off polished rod. The lower pump is connected to the middle pump by sucker rods. Two packers and necessary packoffs are provided. The pump assembly is run on 7/8-in. hollow sucker rods inside 2-in. tubing. Special precautions must be taken to assure simultaneous seating of the pumps. The lower-zone production crosses over into a string of 1-in. tubing. The middle zone is pumped through 2-in. tubing and the upper zone through hollow sucker rods. The installation is performing satisfactorily. Two others have been made since the first was placed in operation.

Under proper well conditions dual-zone pumps furnish an economical approach to the problem of pumping dual-zone completions. The limiting factor of its use is the combination of the questions of depths of pumping, volumes of fluid to be lifted and characteristics of the producing zones.

Dual pumping units. To increase the flexibility of dual-rod pumping, a few installations were made in which each of the zones had its own tubing and rod strings and pump, with the rods actuated by one pumping unit through a modified "dual" horsehead, Fig. 51. This was more flexible than a dual-zone pump because one of the pumps could be shut down. This type of installation found limited acceptance and gave way to an arrangement in which each of the two zones had its own independent sucker-rod system, from the pump to the pumping unit. This method assures flexibility.

The big problem in this arrangement was clearance in surface equipment.[3] For instance, with a conventional dual tubing head with 7-in. casing and 2 3/8-in. EUE tubing, the distance between center lines of tubing strings was 3 1/16 in. This did not leave any clearance between carrier bars of the two polished rods and between the tubing of one zone and the stuffing box of the other.

In the first Mid-Continent installation of this type, made in June 1954, one of the units was elevated, Fig. 52, so that the carrier bars did not pass each other. Taking 1/8 in. off the stuffing box gave a clearance of 1/8 in. between the box and tubing.

Later, as the original installation proved the method to be practical and as other installations were made involving larger units, the cost of elevating one unit became excessive. Special components were developed allowing the units to be placed at the same level. These included dual tubing heads with distance between tubing strings increased, streamlined combination polished-rod grip and carrier bars and carrier-bar guard shields preventing the bars from locking in case they swing together. Beam safety switches were used to shut down the units if the bar struck the shield.

In some installations two top joints of the 7-in. casing were backed off and replaced with 9 5/8-in. casing. As the trend toward smaller casing developed, use of smaller than 2 3/8-in. tubing permitted continuous use of the method. Arrangements were provided for weighing of individual zones with a dynamometer.[4]

A dual pumping-unit installation is, of course, more expensive than one using a dual-zone pump. Often, however, the difference in initial cost was quickly paid out by decreased operating cost and increased production. Also, the method permitted dual pumping of wells which could not be handled by dual-zone pumps because of well characteristics.

A new development which promises possible reduction of initial cost is application of the old principle of backside pumping. Such an installation consists of a conventional unit, called the "primary" unit, which pumps one well and operates, through a steel linkage, a beam-balanced pumping jack, called the "secondary" unit, which pumps the second well. The pumping cycles of the two units are so phased that the curve of the net torque on the reducer of the primary unit is quite flat. Net torque is the result of the torque due to the net well loads of both wells and the torque due to the rotary counterbalance of the primary unit. Sufficient power must be provided to lift the fluid from both wells. Several such installations are now in operation.

For slim-hole shallow pumping of triple completions, three pumping units are used. In one such application the pumping units have special horseheads with pointed bridle faces, single bridle-lines and special polished-rod hangers. The units are set 60° apart in a semicircle, leaving the other part of the circle free for well servicing.

References

1. M. C. Boyd, "Production of Dually Completed Wells with Tandem Rod Pumps." A paper presented before the API Division of Production Meeting in Dallas, March 1960. See also The Oil and Gas Journal, April 19, 1960.
2. David N. Newby, "Here's How to Pump a Triple Completion": World Oil, March 1959.
3. J. Zaba, Henry Shaefer and George O'Neal, "Producing Dually Completed Wells": Drilling and Production Practice, 1956, p. 26.
4. Joe Chastain: "How to Weigh Dual Pumping Wells," The Oil and Gas Journal, August 1, 1960.

37. How to determine performance and ultimate recovery by exponential decline-curve analysis

BY E. T. GUERRERO

GIVEN: The production data shown in columns 1, 2, and 3 of Table 1 through 1953 are for a Kansas sandstone pool. It is estimated that the economic limit for this pool will be 25 bbl. per day.
FIND: Using analytical and graphical approaches, determine reserves and performance of this pool.
METHOD OF SOLUTION: These equations involving production rate and decline rate will be used in the solution of this problem:

$$D = -\frac{dq_o/dt}{q_o} = -\frac{2.3 \log (q_{oi}/q_o)}{t} \approx \frac{q_o/\Delta t}{q_{o\,av.}} \qquad (1)$$

$$q_o = q_{oi}\,\epsilon^{-Dt} \qquad (2)$$

$$\text{Reserves} = \frac{q_o - q_{oi}}{D} \qquad (3)$$

SOLUTION: Using the data for 1948:

$$D = \frac{99200 - 88210}{(1\text{-}0)\ 99200 + 88210/2}$$

$$= 0.117\ \text{yr.}^{-1}$$

Equation 2 can be used to compute the remaining life to abandonment.

q_{oi} = 38,770 bbl./yr. (rate at beginning of eighth year).

$q_{o\,(abnd)} = 25 \times 365 = 9{,}125$ bbl./yr.

Thus $9{,}125 = 38{,}770\ \epsilon^{-.145\,t}$

$0.145\,t = \ln (38{,}770/9{,}125) = \ln 4.25$

$t = 1.447/0.145 = 10.0$ yrs.

$$\text{Remaining Reserves} = \frac{38{,}770 - 9{,}125}{0.145} = \frac{29{,}645}{0.145}$$

$$= 204{,}448\ \text{st.-tk. bbl.}$$

DISCUSSION: Decline-curve analysis is the most commonly used method of determining reservoir performance and reserves. Data needed to correlate production rate, time, and cumulative recovery are readily available and are generally accurately recorded.

But some assumptions must be made:

1. Reservoir is produced at capacity.

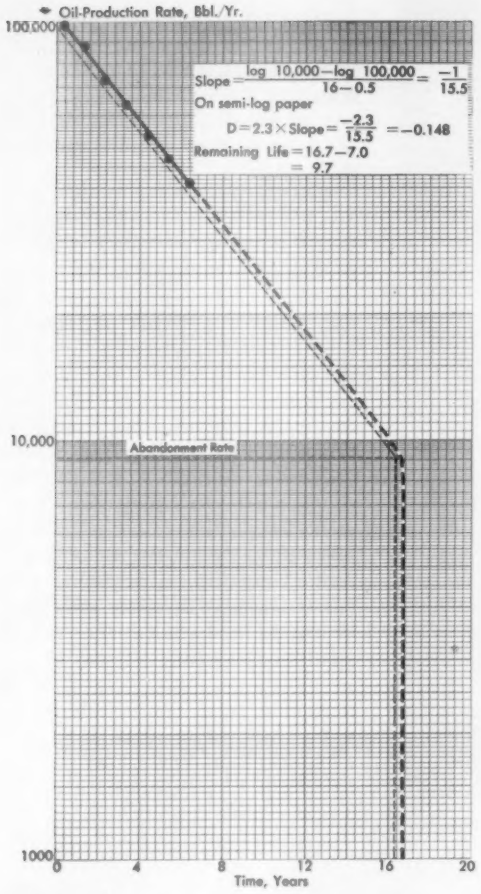
2. Future performance of a reservoir will be similar to its past performance.

Although the word reservoir has been used, the technique can be applied to a well or lease.

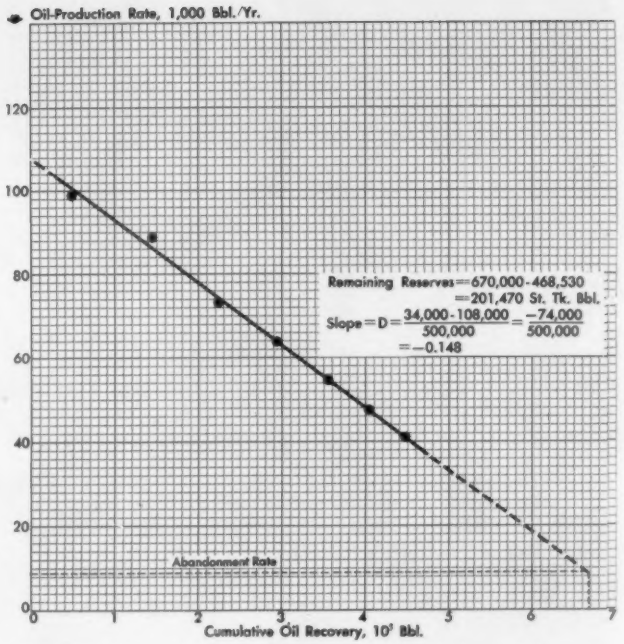
The first assumption implies that the method cannot be used where the rate of oil production is constant or nearly constant with time. This would be true under proration or where the reservoir had a large gas cap or an active water drive. A change in production rate with time is implied and the method should be used on depletion-type reservoirs producing at capacity. Under proration conditions the method will work as soon as the wells are not

TABLE 1—PRODUCTION DATA AND COMPUTATION OF YEARLY DECLINE FOR KANSAS SANDSTONE POOL

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					$q_{oav.} = \frac{(4)_{n-1} + (4)_n}{2}$	$D = \frac{\Delta q_o/\Delta t}{q_{oav.}}$		$N_p - \frac{\Delta N_p}{2}$
Year	Time, years—Total	Time, years—Avg.	q_o = Oil prod. rate, bbl./yr.	Δq_o $(4)_{n-1} - (4)_n$		(5) ÷ (6)	N_p = Cum. oil recovery, bbl.	(8) − (4)/2
1947	1	0.5	99,200	.....	.....	....	99,200	49,600
1948	2	1.5	88,210	10,990	93,705	0.117	187,410	143,305
1949	3	2.5	73,240	14,970	80,725	0.185	260,650	224,030
1950	4	3.5	63,990	9,250	68,615	0.135	324,640	292,645
1951	5	4.5	54,910	9,080	59,450	0.153	379,550	352,095
1952	6	5.5	47,400	7,510	51,155	0.147	426,950	403,250
1953	7	6.5	41,580	5,820	44,490	0.131	468,530	447,740
						0.868		
Future Performance					$D_{av.} = 0.868 \div 6 = 0.145$			
1954	8	...	35,960	5,620	38,770	0.145	504,490	.....
1955	9	...	31,099	4,861	33,530	0.145	535,589	.....
1956	10	...	26,895	4,204	28,997	0.145	562,484	.....
1957	11	...	23,260	3,635	25,078	0.145	585,744	.....
1958	12	...	20,116	3,144	21,688	0.145	605,860	.....
1959	13	...	17,397	2,719	18,757	0.145	623,257	.....
1960	14	...	15,045	2,352	16,221	0.145	638,302	.....
1961	15	...	13,011	2,034	14,028	0.145	651,313	.....
1962	16	...	11,252	1,759	12,132	0.145	662,565	.....
1963	17	...	9,731	1,521	10,492	0.145	672,296	.....
1964	18	...	8,416	1,315	9,074	0.145	680,712	.....



VARIATION of oil-production rate with time. Fig. 1.



RELATION of oil-production rate and cumulative oil recovery. Fig. 2.

able to produce their allowable.

The second assumption implies that past performance is used to predict future performance. In other words, the production rate will decline in the future in a manner similar to that of the past. Any workover or cleanout operations may likely result in higher production rates than predicted by the analysis. Thus it must also be assumed that the conditions of the hole and sand face will remain unchanged.

The most commonly used types of decline are the constant-percentage or exponential decline and the hyperbolic decline.[1,2,3,4,5] This problem illustrates the exponential decline-curve analysis. Year-by-year performance has been computed analytically in Table 1 and is shown graphically in Figs. 1 and 2. Future performance computations of Table 1 are obtained using Equations 2 and 3. Use of these equations to determine remaining life and reserves is shown in the example calculations.

The same values can be obtained from Figs. 1 and 2. Note that the rate of decline from the graphs is slightly larger than that computed in Table 1. The graphical value is actually better since the rate of decline is an instantaneous value and thus theoretically can be applied to only a very short time interval. In Table 1 intervals of 1 year were used in its computation. Note that the computation of D from Equation 1 involves a slope at a certain rate q_o. However, in Table 1 it has been computed using an approximation of increments in rate and time and an average rate in the time increment.

In the graphs the rates were plotted at the mid-point of the time-cumulative recovery intervals. This provides a correction for the fact that the time interval used may be larger than permissible. This correction is an added precaution which in most practical cases is not necessary as the resulting error is small.

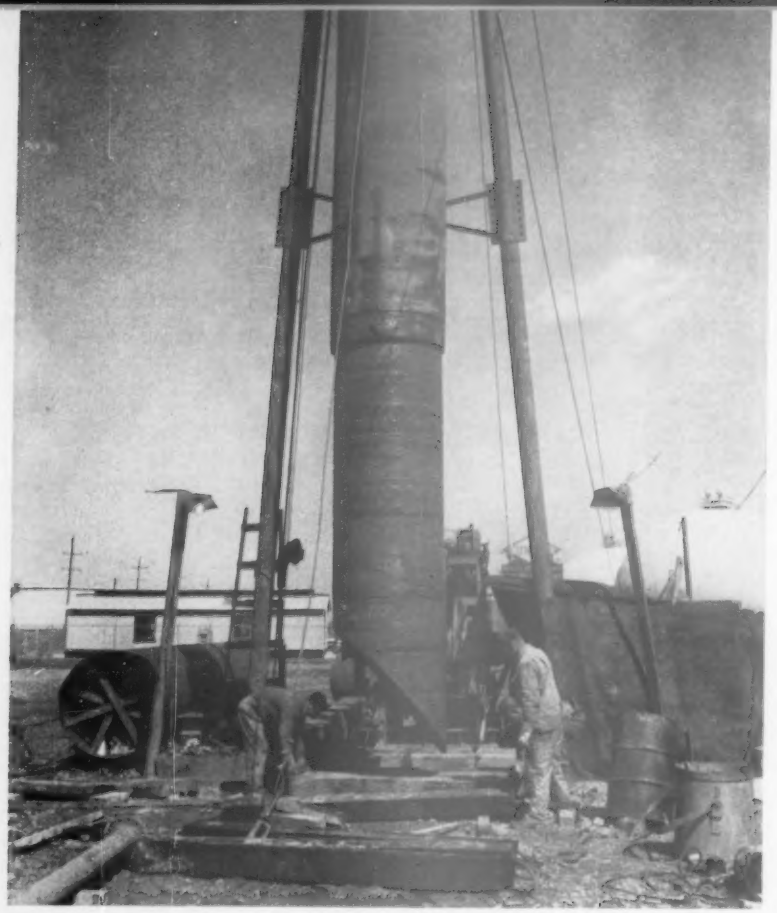
In this example the results obtained by the two methods are in satisfactory agreement. In practice the graphical approach is used most. The analytical method is useful in determining the type of decline. Note in column 7 of Table 1 that the rate of decline remains fairly constant at about 0.145. This indicates an exponential type of decline. If the rate decline in column 7 were increasing, a hyperbolic type of decline would have been indicated. Its recognition and analysis will be considered in the next problem.

NOMENCLATURE

q_o = oil-production rate.
q_{oi} = initial oil-production rate.
D = rate of decline (inverse of loss ratio).
t = time.

References

1. Arps, J. J., "Analysis of Decline Curves": Trans. AIME, (1945), 160, 228.
2. Arps, J. J., "Estimation of Primary Oil Reserves": Trans. AIME, (1956), 207, 182.
3. Pirson, S. J., "Mathematical Methods of Decline Curve Extrapolation and Reserve Calculation": Oil Weekly, Sept. 9, 1946, 45-59.
4. Menzie, D. E., "How to Select the Best Decline Curve": World Oil, Dec. 1953, 180-196.
5. Clark, R. W., "How to Estimate Crude Oil Reserves by Decline Trend Method": Petroleum Engineer, Sept. 1951, B 7-35.



GIANT 50-IN. CORES were removed with this special lifting device. Fig. 1.

How Sun Oil Co. mines and operates LPG STORAGE CAVERNS

Company will take light hydrocarbons directly from refinery units to storage, and will use deep-well pumps to recover them

BY PAT DOUGHERTY,
Sun Oil Co.
AND GILBERT J. FENIX,
Fenix & Scisson, Inc.

THE OIL INDUSTRY has accepted mined underground storage of LPG as feasible, safe, and economical. There are 36 mined caverns now completed or under construction in the United States.

This storage method offers significant advantages in comparison with aboveground storage from the standpoints of economy and safety. The cost of construction of mined caverns is only a fraction of the cost of steel-tank storage, and maintenance and operating costs also are lower. The depth of underground caverns offers added protection from the hazards of weather, fire, explosion, or enemy attack.

Sun Oil Co. now has three underground caverns mined in granite formations at the Marcus Hook refinery in Pennsylvania. The methods of construction and operation of these caverns are described in this article.

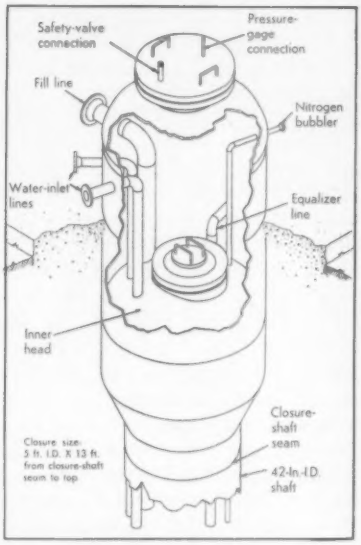
Construction of No. 1 cavern at Sun Oil Co.'s Marcus Hook refinery began in February 1957 with the drilling of a shaft 52 in. in diameter. The size was determined by the contractor, Fenix & Scisson, Inc. It was large enough to permit the entry of workmen and machinery and the removal of stone, and at the same time small enough to permit effective sealing later against the pressure of the stored product.

The shaft was drilled with equipment comparable to a conventional oil-drilling rig, using a calyx-type drill. This drill, a revolving core barrel 50 in. in diameter and 20 ft. in length, used chilled steel shot as a cutting medium.

Cores were pulled loose from the formation by a special lifting device. These solid cores were from 10 to 20 ft. in length (Fig. 1). Occasionally it was necessary to use a light dynamite charge at the bottom of the core to break it loose. The average drilling progress was from 8 to 10 ft. per 8-hour shift.

After the shaft was drilled to its full depth of 307 ft., the bottom 28 ft. was filled with sand. This sand supported the bottom of the completed casing, and provided space for workmen to start excavating the cavern when it was later removed.

The steel casing, 42 in. in diameter and ⅝-in. wall thickness, was installed in 20-ft. lengths. The bottom end of the first section of casing was plugged with 5 ft. of concrete, and the shaft was filled with water. Because of the concrete plug, the entire steel casing could float, in spite of its great weight. Each section was water-ballasted to a convenient height for welding the next section and connecting exterior piping for grouting, power, and air lines. Tack-welded longitudinally to the outside of each section were two 1½-in. pipes for use in the grouting process when the cavern neared completion. Several other pipes, ranging from 1 to 2 in. in diameter, also were welded lengthwise to the outside of the casing to carry power and air lines. Four



SHAFT CLOSURE, using unique double-pressure heads, eliminates possibility of large-scale leakage and increases safety of cavern operation. Fig. 2.

truck leaf springs were welded to the outside of each section, 90° apart, as centering devices.

When the casing, lengthened by added sections, reached the sand plug at the bottom of the shaft, it was pressure-grouted into place. Water was pumped from the casing, the casing dewatered, and a workman lowered to chip out the concrete plug with a jackhammer.

The sand plug at the bottom of the shaft then was removed, and a workman, using a jackhammer, drilled diagonal blast holes around the side of the shaft, just below the steel casing. When the sides of the shaft were dynamited, the broken rock fell into the base of the shaft. The hole around the shaft was widened by drilling and blasting until the rubble was level with the bottom of the enlarged opening. The rubble then was hauled to the surface with a mine bucket.

The proposed cavern outline, height, and pillar spacing are designed, in principle, in the drafting room before construction is begun. These designs are subject to change during the mining operation. At all times, extreme flexibility of operation must be permitted. This will allow the contractor to take full advantage of any geologic irregularities that may occur, with resulting economies to the owner.

As the widened space permitted, additional workmen were used to continue drilling and dynamiting around the base of the shaft. Eventually, a 25-man crew was able to dig out a series of drifts or tunnels. Two 60 hp. diesel-driven bulldozers, lowered in sections to the bottom of the shaft and reassembled in the cavern, were used to push the rubble to the base of the shaft for removal.

Sun's No. 1 cavern is a series of doughnut-shaped tunnels, 35 ft. wide and 37 ft. high. Seven pillars were left standing to support the roof, the smallest of these being approximately 40 ft. sq. The walls of the cavern are sheer and rough. As completed, the cavern has a capacity of 250,000 bbl. and covers about an acre of underground area.

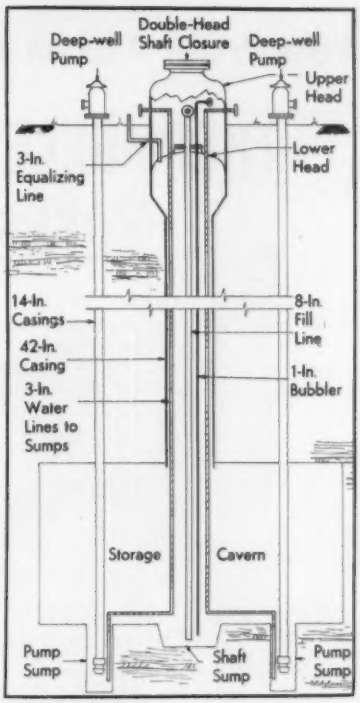
The No. 2 cavern has a storage capacity of 400,000 bbl. and will be used for the storage of propane. The cavern floor is 420 ft. below ground level. The No. 3 cavern has a depth of 350 ft. from ground surface to cavern floor, and will be used for the storage of 250,000 bbl. of butane. Excavation has been completed on these last two caverns and the installation of aboveground piping and other equipment is nearing completion.

Shaft closure. On No. 2 and No. 3 caverns, Sun is incorporating a double-seal shaft closure as an additional safety feature. The double pressure head, as shown in Fig. 2, will eliminate the possibility of large-scale product leakage should extensive damage occur to the aboveground shaft seal. This safety measure has been hailed as a significant contribution to the safety of underground storage caverns.

A sump has been dug in the floor of the cavern, directly beneath the shaft (Fig. 3). The 8-in. fill line extends to within 2 ft. from the bottom of the sump. This sump has a concrete bottom and a manganese steel impingement plate under the fill line. It has a capacity of 8,000 gal., or about 10 times the amount required to provide sufficient water to seal the fill line, should a break occur above the lower pressure head.

The end of the 1-in. nitrogen bubbler line also is immersed in the shaft sump to provide a water seal should a break occur.

Of special interest are the 3-in. fill lines which will provide water to the pump sumps when required.



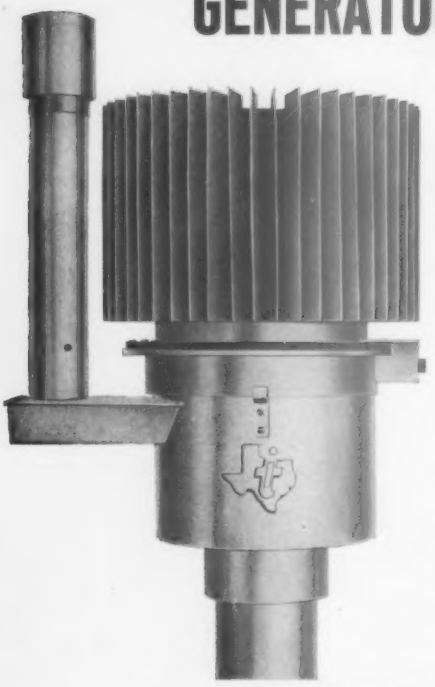
SUMPS in cavern floor prevent product leakage in case of line breakage, and allow pumps to be easily pulled for maintenance. The double head closure is prefabricated and welded, as a unit, to the 42-in. shaft casing. The 3-in. pump lines provide water to fill pump sumps and 14-in. casing. This water provides a seal to permit removal of pumps for inspection and repairs. The 1-in. bubbler is used, in conjunction with the 3-in. equalizer line, to measure liquid level in cavern. The 3-in. equalizer line also equalizes pressure between cavern and surge tank. The 8-in. fill line extends within 2 ft. of bottom of shaft sump. All lines going into cavern, with exception of the 3-in. equalizing line, have an automatic water seal if a break should occur above the lower pressure head. Fig. 3.

Also, water which accumulates in the pump sumps will be forced up these 3-in. lines until equilibrium is reached between the vapor phase of the product and the hydrostatic head of water in the line. Thus, when it is desired to remove the pumps for repairs or inspection, water may be supplied from a relatively low-pressure (70-psi.) source, removing the necessity of using high-pressure pumps to overcome product pressure at the inlet valve.

The 3-in. equalizer line has, of necessity, no such safety feature. However, as it comes off the pressure head, it is encased in concrete, and is carried underground for a distance of several feet before it connects with other surface piping.

new from Texas Instruments

THERMOELECTRIC POWER GENERATOR



Unattended Power Source for

- **Automatic Controls**
- **Telemetry Equipment**
- **Cathodic Protection**
- **Emergency Power**

NO MOVING PARTS!

Texas Instruments Thermoelectric Generators provide an economical, maintenance-free power source for a variety of unattended, remotely located equipment. This completely new design uses no moving parts and can be operated on natural gas, propane, butane or other combustible fuel . . . provides power where commercial service has never been available.

The TI Thermoelectric Generator is built to withstand full exposure to the elements . . . no housing or special enclosure is required. Long-term reliability is assured by ruggedized construction and simplicity of basic design. Installation and operation are easily handled by regular field personnel.

Write for complete information.

APPARATUS DIVISION
PLANTS IN HOUSTON AND DALLAS, TEXAS

TEXAS INSTRUMENTS
INCORPORATED
3609 BUFFALO SPEEDWAY
P. O. BOX 6027 HOUSTON 6, TEXAS

439

Consequently, if a break in this line or in the upper head should occur, it will be several feet distant from the closure and other piping.

Operation. While a christmas-tree type of manifold with input and output water lines is used to inject and recover product from salt cavities, the operation of a mined cavern is relatively simple. In a survey conducted by the National Petroleum Council for its 1957 report, eight operators of mined caverns reported on the procedures they used to store and recover light-petroleum hydrocarbons. One operator reported that differential pressure was used to inject the product. The seven others injected the product either directly from processing units or by use of conventional pumping. Four of these operators used compressors with differential pressure to recover the product from the storage cavity, and the others used deep-well pumps.

A logical question regarding the use of the deep-well pumps concerns their accessibility for repair or inspection after the cavern has been sealed. In Sun's caverns, deep-well pumps are encased in 12 or 14-in. casings, depending on the pump size. The casings extend from the ground surface to within 8 ft. of the bottom of the pump sumps. The pump suction protrudes about 2 ft. below the bottom of the casing. These pump sumps are 7½ ft. in diameter and 30 ft. in depth from the cavern floor. When it becomes necessary to repair the pump or replace it, water will be injected through the 3-in. fill line into the 12-in. pipe until the hydrostatic pressure in the pipe and sump exceeds the vapor pressure of the material in storage, creating a water seal. The pump then can be easily removed.

In the operation of its caverns, Sun will take light petroleum hydrocarbons under pressure directly from refinery units to storage, and will use deep-well pumps for recovering the material. After approximately 2 years of service, Sun reports that no problems of any type have been encountered in the operation of its first granite cavern. Butane is metered in and out with turbine meters having an accuracy of ± 0.05%, and no losses have been experienced.

Economy dictates use of air-cooled heat exchanger

UNTIL RECENTLY, normal process-cooling requirements at many refineries were met by water-cooled shell-and-tube equipment. However, the high investment cost of additional pumping capacity, pipelines, sewers, and water-treatment facilities plus the expenses caused by corrosion, freezing, scaling, and fouling has made it more economical to install air-cooled exchangers in some cases.

Fig. 13 shows a sectional view of a typical forced-draft air-cooled heat exchanger. This unit has a single tube bundle, four tube rows deep. There is no standard bundle, but for ease of fabrication and installation, an 8 by 24-ft. bundle, four rows thick is used extensively. If more than one of these bundles is required, as many as three to four may be stacked vertically. When still more surface is required, additional units, located side by side, are provided. Frequently it is economical to combine several small units into one installation.

Extended-surface (finned) tubing has been found to be the best type of heat-transfer surface. Air is passed along the finned tubing while the fluid being cooled flows through the tubes which are joined at both ends to manifolds or headers.

Air is circulated by multiblade propeller-type fans providing either forced or induced drafts. Fans can be supplied with either adjustable speed or variable pitch. The fan-blade pitch can be changed either manually or automatically to vary the air-flow rate to compensate for variations in air temperature; thus maintaining a constant tube-side fluid outlet temperature.

Air coolers supplied with multiple fans may be operated with some of the fans shut down. Dampers, baffles, and bypasses can also be used to further control fluid outlet temperature.

This material taken from process-training program manual, Bayway, N. J., refinery of Humble Oil & Refining Co.

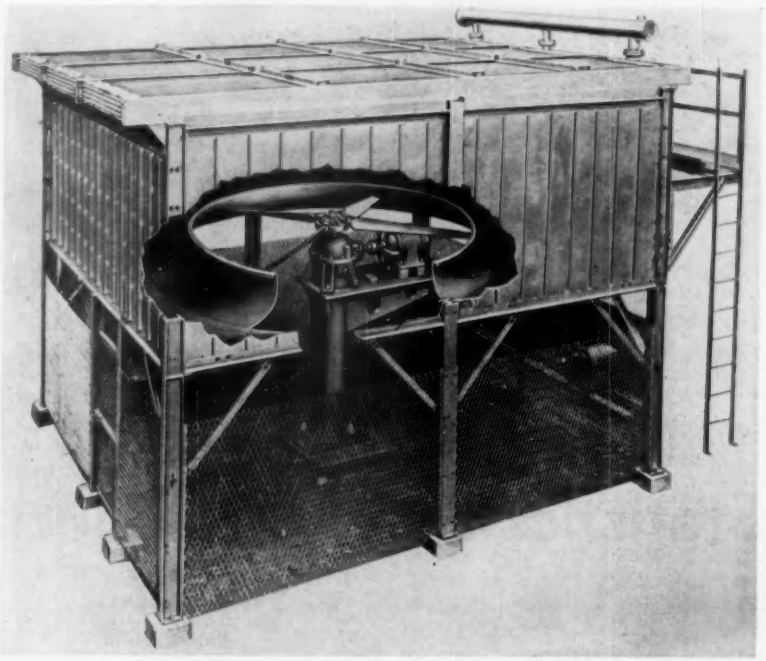
Summary

Heat is a form of energy. It can be transferred by three methods: conduction, convection, and radiation.

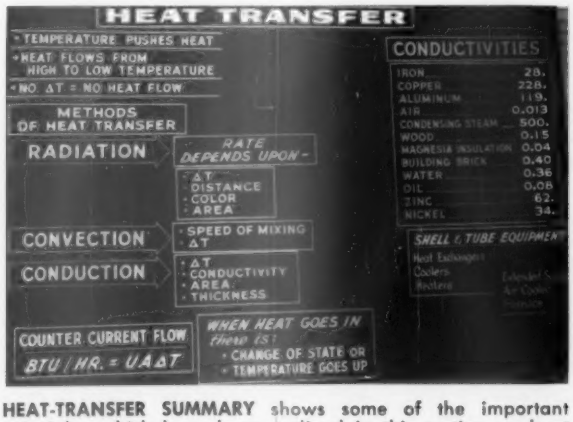
Furnaces, heat exchangers, etc., are used to transfer heat. They do it by any or all of these methods.

Supplying heat for a refinery is costly, and inefficient use of heat-exchange equipment can mean the difference between making money and losing money.

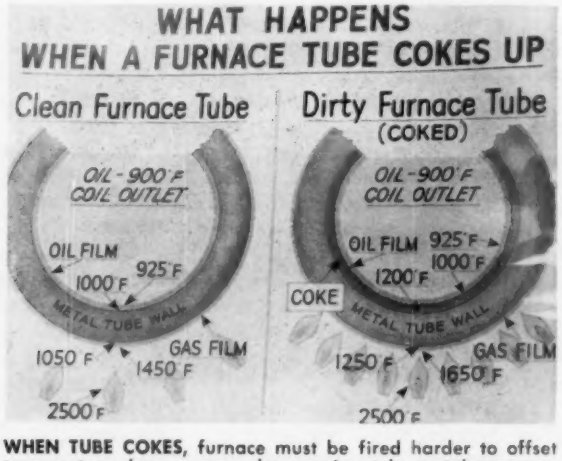
Figs. 14 and 15 summarize several of the important things you learned in this section.



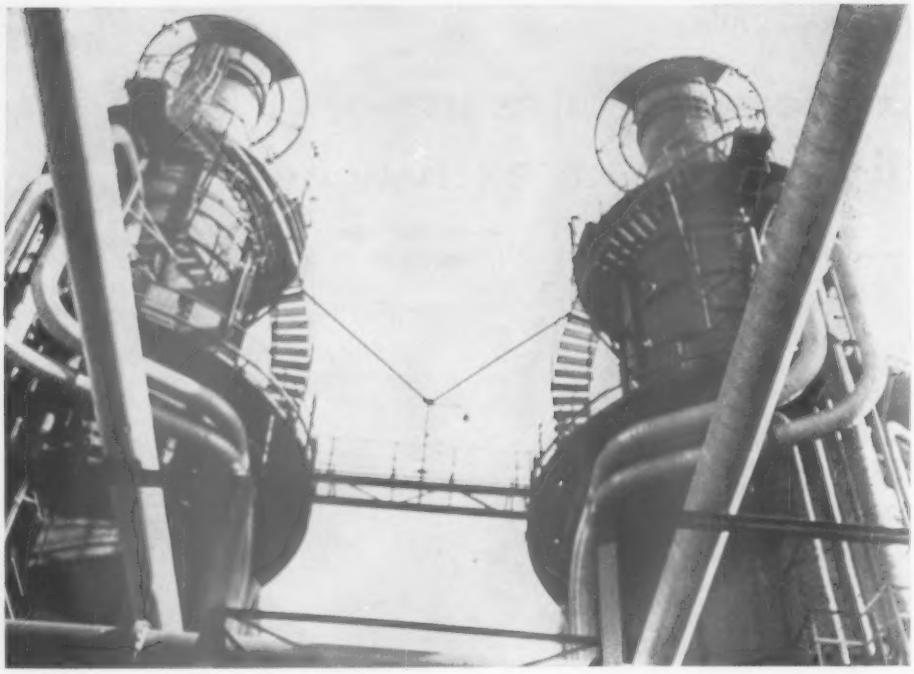
AIR-COOLED EXCHANGER. Air is circulated around finned tubes to cool the fluid inside. This type of exchanger is becoming more and more popular. Fig. 13.



HEAT-TRANSFER SUMMARY shows some of the important principles which have been outlined in this section on heat transfer. Fig. 14.



WHEN TUBE COKES, furnace must be fired harder to offset temperature drop across coke, causing tube-metal temperature to increase. Fig. 15.



KNOTTY PROBLEM of determining when to scrap these crude-unit furnace-outlet lines was solved by statistics. With this technique, inspectors can predict not only the time to replace corroded piping, but also can predict the number of data points necessary to get a reliable forecast. Fig. 1.

Refinery inspections are gradually replacing guesswork with statistics. Through this method data points can be preselected rationally. Although there have been risks in inspection work, the risks can now be put in quantitative terms. Here's a case in which . . .

Statistics solve an inspection problem

BY W. P. SHONTZ
Inspection Consultant
Standard Oil Co. (Ohio)
Cleveland

INSPECTION ENGINEERS at Standard Oil Co.'s (Ohio) Cleveland refinery had a serious problem to consider. Crude-unit furnace-outlet piping on each of twin crude units showed differing corrosion rates. And on one of the units the corrosion rate seemed to be unpredictable.

This posed a problem: How often should the system be inspected; how many data points would be necessary to complete the inspection; and at what cost?

Sohio engineers came up with the following plan:

. . . On new piping, a sample would be taken after only 1 year of operation. This would show whether there was an unpredictable corrosion rate.

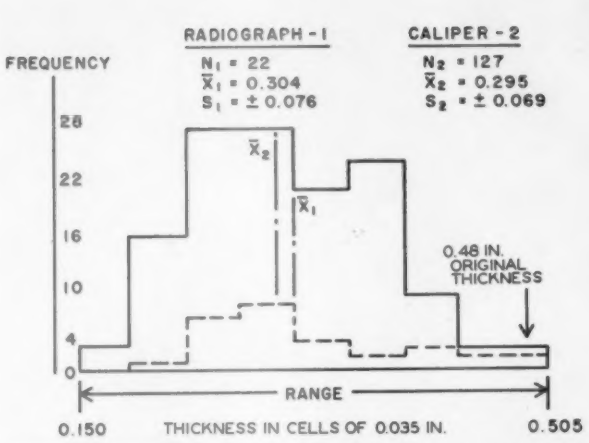
. . . After 4 years of operation another sample would be taken to verify previous corrosion rates and to predict the time at which the piping should be replaced. This second plan would take care of 90% of refinery pipe. At least this percentage is in the low to medium-corrosion-rate class.

In addition, by the use of statistical analysis, inspectors could predict how many data points would be necessary to get the required accuracy for a prediction. By knowing the required number of data points, they could also predict the cost of inspection.

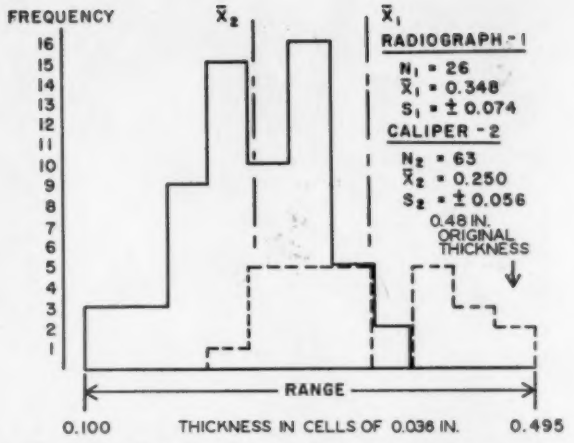
Background. Thickness distributions of one of the crude-unit transfer lines (Fig. 2) satisfactorily predicted replacement of the system.[1,2] There is close agreement between the radiograph and caliper measurements shown in Fig. 2 for this system. These plots show sets of measurements which were taken at the same time.

Data for the other unit's transfer line are shown in Fig. 3. These data also correctly predicted when the piping should be replaced. However, in this case, the sets of measurements were not taken at the same time. These data show the effect of 8 months of service between radiograph samples and the caliper checks which were made when the piping was scrapped. Note that the shift in the mean from 0.35 in. to 0.25 in. meant that recently there may have been an accelerated corrosion rate.

Potential errors. The estimate of current corrosion rate shown in Fig. 3 was higher than good judgment would say was possible. Neverthe-



THICKNESS DISTRIBUTION showing both radiograph and caliper readings on No. 2 crude unit. Both types of samples were taken after 7 years of continuous service. Fig. 2.



THICKNESS DISTRIBUTION showing both radiograph and caliper readings on No. 1 crude unit. Pipe was in service for 8 months between the radiograph samples and the caliper checks which were made when the line was scrapped. Fig. 3.

less this was no reason for ignoring it. There was too great a risk of failure if the data proved correct.

To assume that the high rate was absolutely true, however, would mean overlooking several important points.

For example, two distinctly different methods were used to get the data in Figs. 2 and 3. Both radiographic measurement and hand caliper measurement had been assumed to yield the same quality of information.

In addition, Fig. 3 shows that there were only 26 radiograph data points, while there were 63 caliper data points. Sampling cost and inaccessible piping locations made strict random sampling impractical in both cases.

Finally, the assumption of normal thickness-distribution curves could have an effect, if thickness data actually belonged to some other type of distribution.

Regardless of these sources of error, refinery inspectors could not take a chance on the possibility of a high corrosion rate existing without their knowledge. The piping system could not be permitted to fail in service because it could cause a serious fire.

Inspection plan. Originally the No. 1 unit line (Fig. 3) lasted 7.5 years. The serious pitted condition of the pipe wall at the end of its service is shown in Fig. 4.

With a predictable corrosion rate, the new pipe would not need inspection until after 3 to 4 years of service. This would guarantee that, if a rapid corrosion rate existed, inspectors could get a good estimate of it at minimum cost and proceed from there. If no high rate existed at the end of the first year, the period between inspections could be increased.

Table 1 shows data needed for computing each of the two sampling plans.

One plan calls for the first inspection after 1 year of service. The other calls for inspection just beyond the estimated half-life period of this piping, say 4 years.

Sample Size Calculations

Formulas used. Two formulas were used to calculate the number of samples. They can be found in most standard statistical texts.

$$N = \left(\frac{S}{\sigma_X}\right)^2 \qquad (1)$$

$$2N = \left(\frac{S}{\sigma_s}\right)^2 \qquad (2)$$

Where:

N = number of samples.

S = standard deviation.

(σ_X) = the standard error of the mean $(_X)$.

σ_s = standard error of the standard deviation (S).

The formula producing the largest N would furnish the required answer because it would automatically satisfy both equations.

Values of S shown in Table 1 were determined from computations on earlier data.

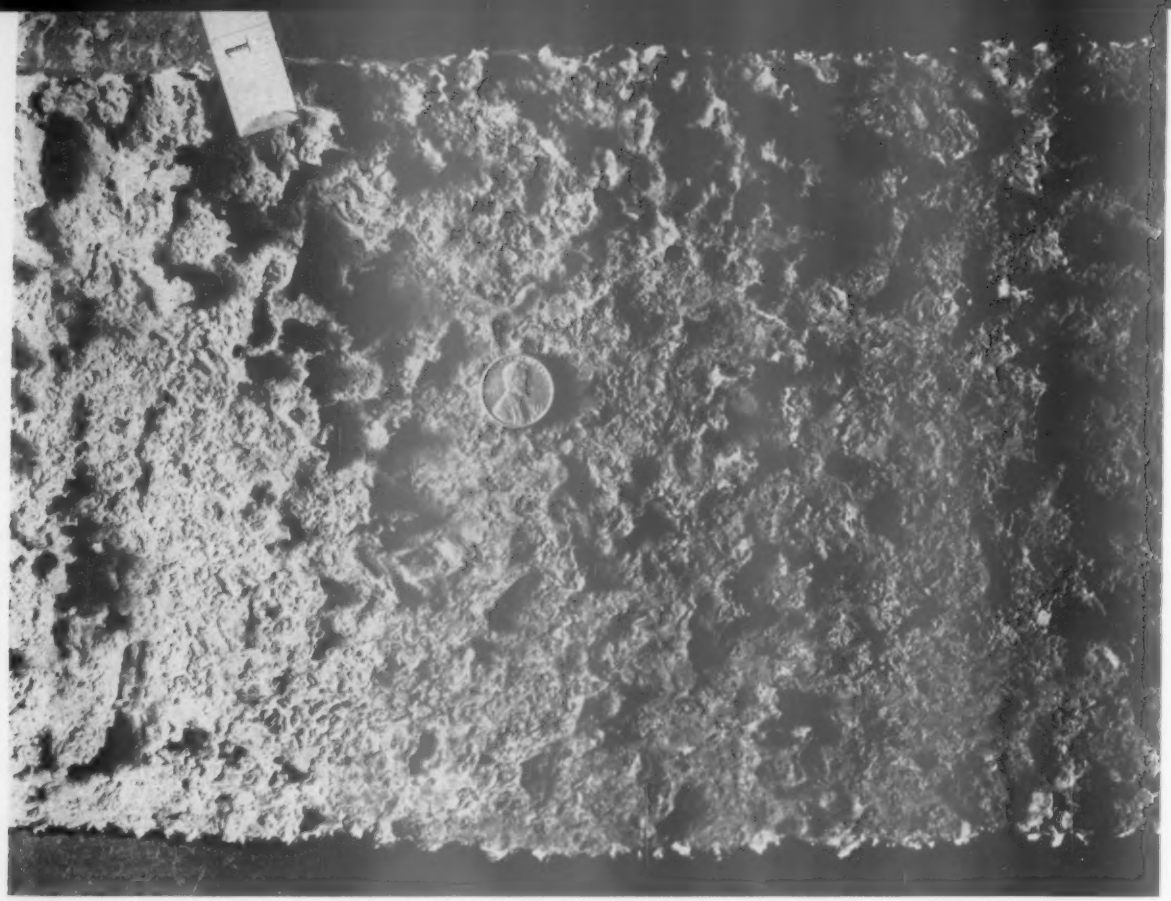
Values for σ_X and σ_s were set by knowledge of accuracy needs. They are actually expressions of calculated risks and could only be assigned by someone with knowledge of the system.

Standard error of the mean σ_X. After 1 year of operation a group of N thickness readings would be averaged to give a mean measurement, X. Since X would be used to predict some minimum probable thickness it was important that X be accurate enough to cause very little chance of misinterpretation.

TABLE 1—NO. 1 CRUDE-UNIT TRANSFER-LINE PIPING THICKNESS DATA

Original thickness	Radiograph inspection after 7 years' service	Caliper readings after 7.75 years of service
X = 0.48 in.	$X_1 = 0.35$ in.	$X_2 = 0.25$ in.
S = ±0.01 in.	$S_1 = \pm 0.074$ in.	$S_2 = \pm 0.056$ in.
	$N_1 = 26$	$N_2 = 63$
	S (4 yrs.) = ±0.04 in.	
		Corrosion rate (0.48 − 0.25) ÷ 7.75 = 0.029 i.p.y.

X = arithmetical mean.
N = number of sample.
S = standard deviation.



CORRODED PIPING which carried crude from the furnace to the atmospheric unit had been in service 7.5 years. Statistical analysis correctly predicted replacement time. Fig. 4.

Originally the mean thickness was 0.48 in. If 1 year's corrosion reduced this to say 0.45 in., the rate would not be alarming.

Suppose though, that too small a sample produced a wide sampling error. Then the 0.45-in. mean could have a reasonable probability of representing a smaller mean of 0.40 in. This would be an alarming corrosion rate.

If the probability of such an error is minimized, it shows that one is controlling the standard error of the mean. By using 3 sigma limits of a normal distribution and 0.05 in., (0.45 less 0.40), $\sigma_{\bar{x}}$ was determined for the formula by dividing 0.05 by 3, or ±0.0166 in.; see line 2 of Table 2.

The 3 σ limit indicates that a confidence level of 99.7% has been established, so the chance of a sampling error is 100% less 99.7% or 0.3%. However, pipe thickness may be on the heavy side of the distribution. So, the actual chance of error was only ½ of 0.3% or 0.15%. And the probability of a mean thickness of 0.45 in. actually representing one of 0.40 in. was only 0.0015.

SDσ_s. Standard deviation has to do with the range of thickness measurements. Should measurements be taken that were all the same, there would be no deviation. However, both Fig. 2 and Fig. 3 showed that the range of measurements was very wide.

Standard deviation values are used to predict minimum existing pipe thicknesses, although the minimums may never actually have been measured and recorded. For example, assume a mean thickness of 0.36 in. is obtained from a sample and the standard deviation is ±0.056, (S_2 in Table 1). The minimum anticipated thickness at the 3 sigma limit would be 0.36 minus 3 times (0.056) or 0.19 in.

Should the standard deviation be only ±0.030 in., however, the minimum anticipated thickness would be 0.36 − [3 (.03)] = 0.27 in. This would not be alarming.

Danger of misinterpretation lies in the fact that a sample which would produce an S of ±0.03 in. should have a very small probability of unknowingly representing an S of ±0.056 in. (The numbers $_{\bar{x}}$ = 0.36 and S = ±0.03 were selected merely for the purpose of rea-

TABLE 2—FIRST YEAR INSPECTION SAMPLE ESTIMATED VALUES (INCHES)

1. $S = \pm 0.056$

2. $\sigma_{\bar{x}} = \pm \dfrac{0.05}{3} = \pm 0.0166$

3. $\sigma_s = \pm \dfrac{0.026}{3} = \pm 0.0086$

4. $N = \left(\dfrac{S}{\sigma_{\bar{x}}}\right)^2$

$= \left(\dfrac{.056}{.0166}\right)^2 \cong 11$ samples

5. $2N = \left(\dfrac{S}{\sigma_s}\right)^2$

$= \left(\dfrac{.056}{.0086}\right)^2 \div 2 \cong 21$ samples

Cost of samples (Radiograph) $20 each.

TABLE 3—FOURTH-YEAR INSPECTION PLAN

Best Estimate Values—

1. Corrosion rate (from Table 1) = 0.029 i.p.y.
2. Avg. "t" after 4 years; 0.48 − 0.116 ≅ 0.36 in.
3. Permissible error for Avg. "t", line 2, = ±0.04 in. at 3 σ limits.
4. SD per year (estimated) = ±0.01 in.
5. SD after 4 years = S = ±0.04 in. (Table 1).
6. Permissible error on SD, line 5, = ±0.02 in. at 3 σ limits.
7. σ_X = ±0.04 ÷ 3 = ±0.0133 in.
8. σ_s = ±0.02 ÷ 3 = ±0.0066 in.

Formulas:

$$N = \left(\frac{S+}{\sigma_X}\right)^2 = \left(\frac{.04}{.0133}\right)^2 \quad N \cong 9 \text{ samples} \qquad (1)$$

$$2N = \left(\frac{S}{\sigma_s}\right)^2 = \left(\frac{.04}{.0066}\right)^2 \quad N \cong 18 \text{ samples} \qquad (2)$$

Cost of samples $20 each.

soning out the needed accuracy.

Standard error of the standard deviation, σ_s, was computed by subtracting 0.03 from 0.056 and dividing by 3 to again give the 3 σ confidence limit; line 3 of Table 2.

First-Year Plan

The first plan was considered a special problem necessary for the No. 1 crude unit transfer lines because:

1. No risk of failure could be allowed.
2. Corrosion mechanism was unpredictable.
3. Extent of error in previous data was unknown.

Therefore the purpose was to devise an onstream inspection plan to protect against an apparent unpredictable situation.

Values have been established for all the unknowns except N in the equations. Lines 4 and 5 of Table 2 show the resulting computations. Twenty-one samples, or thickness data points, were necessary. The cost was $20 each of radiography. (Roughly one-third of this cost was due to the inaccessibility of the line for onstream inspection work; see Fig. 1.)

Fourth-Year Plan

This plan was computed to illustrate a method which could be used on the majority of refinery piping systems. Conditions or assumptions were:

1. No unpredictable or unusual corrosion existed.
2. Corrosion rates were satisfactorily established from past performance.
3. No significant changes in operating conditions were anticipated.

If the first-year plan showed no cause for alarm on the crude-unit transfer-line system, then the fourth-year plan would be put in effect. The fourth-year plan's purpose was:

1. Confirm previous data.
2. Predict replacement date accurately.
3. Preselect the number of measurements necessary in contrast to relying on guess work or intuitive selection.

Table 3 shows the data and computations necessary to arrive at a final sample size of 18 measurements.

Standard deviations in lines 4, 5, and 6 were estimated, based on knowledge of the piping system being studied. Note that if twice the accuracy for the standard deviation was necessary, line 6 would be ±0.01 in. instead of ±0.02 in. Line 8 would become ±0.0033 instead of ±0.0066, but N (from Formula 2) would have to be 74 samples.

The difference in inspection cost between 18 measurements and 74 measurements, at $20 each, was $1,120. Such additional accuracy was not required and it was questionable whether the inspection measurement method could produce this improved accuracy.

References

1. Shontz, W. P., McDaniel, W. W., and Decker, R. R., "Sohio Inspectors Apply Statistical Methods": Paper presented to API Refining Division's twenty-fifth midyear meeting, Detroit, May 1960.
2. Shontz, W. P., McDaniel, W. W., and Decker, R. R., "Statistics Help the Refinery-Inspection Program": The Oil and Gas Journal, p. 123, May 16, 1960.

For Constant, Uninterrupted

POWER FLOW in the OIL FIELDS

You'll Never Go Wrong with

FIELDMASTER

BALL BEARING MOTORS

Here's Why . . .

They are specifically designed to overcome the unusual conditions of Oil Field requirements, and there is a type and H.P. built to fit your exact needs. Unexcelled since they are . . .

- **DRIP PROOF**
- **VERMIN PROOF**
- **MOISTURE PROOF**
- **CORROSION RESISTANT**
- **FORCED AIR COOLED**
- **HAVE SEALED TERMINAL PORT**

SEMI-ENCLOSED — normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings in semi-enclosed protected housing, 40 degree C rise. Built for continuous duty. High Torque, low starting current. Extra insulating coating throughout.

TOTALLY ENCLOSED — Fan cooled, normal or medium slip, 3 phase, 60 cycle. Has prelubricated ball bearings, totally enclosed FAN cooled 55 degrees C rise, for continuous duty. High Torque — low starting current. Extra insulating coating throughout.

Write for fully descriptive literature

BETHLEHEM STEEL CO. Supply Division **Tulsa, Oklahoma**

Manufactured by Valley Electric Corporation, St. Louis 8, Mo.

This Ammonia Refrigerant System Uses ORBIT

In addition to the services shown in these pictures of a Louisiana Gasoline Plant — ORBIT ASA CLASS VALVES are used in other areas of the ammonia refrigerant system, i.e.,

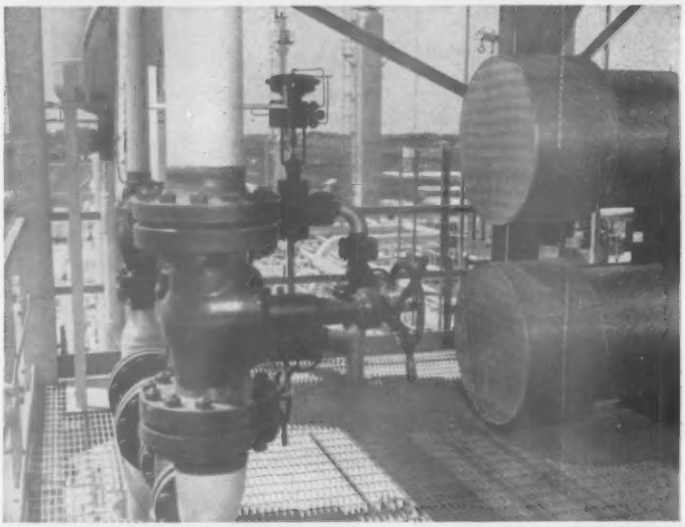
- Relief valves for ammonia condenser
- By-Pass control valves for strong aqua pumps
- Products storage and transfer valves
- Suction and discharge manifolds
- Relief valves for ammonia absorber
- Discharge valves — weak and strong aqua transfer pump

WHERE VALVE SPECIFICATIONS DEMAND NO LEAKS/NO LUBRICANTS, ORBIT ASA CLASS VALVES FILL THE BILL!

ORBIT VALVE COMPANY

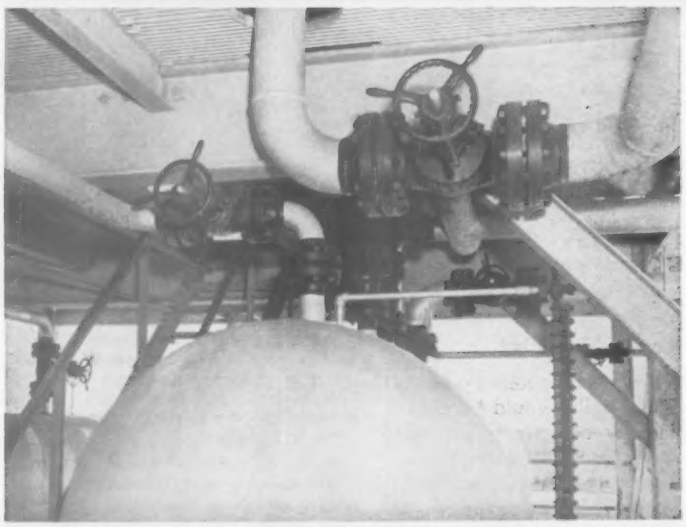
FOR BETTER OPERATION
SAFER, EASIER MAINTENANCE

ASA CLASS VALVES



WEAK AQUA RATE CONTROL VALVE, NEAR SIDE AND AMMONIA STILL REFLUX CONTROL VALVE, FAR SIDE.

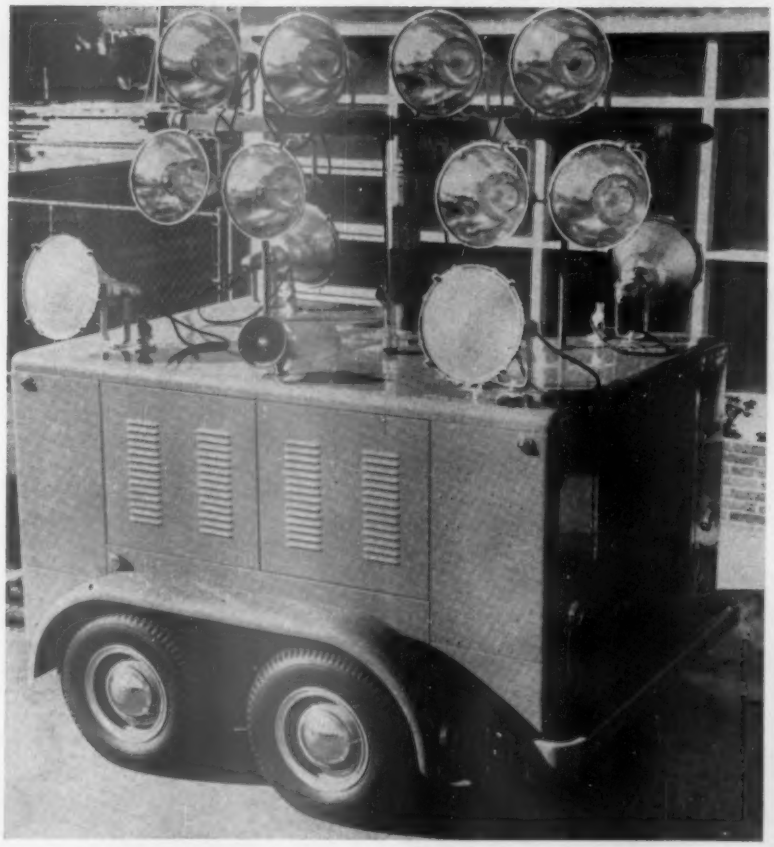
AMMONIA SURGE TANK AND RELATED PIPE.



ORBIT VALVES

P. O. BOX 699 / TULSA, OKLAHOMA
PHONE LUther 4-4761 TWX TU 925

What's NEW . . . in equipment



TELESCOPING MAST raises lights 25 ft. above the ground.

Mobile unit gives light, power

A MOBILE POWER and light source is now available featuring a telescoping mast rising about 25 ft. above ground, mounting eight mercury floodlights with four additional lights on the cab roof below. The mast is push-button-operated, providing infinite vertical positioning from 9½ to 22½ ft. with 360° horizontal rotation.

This self-contained unit provides 25,000 watts of auxiliary power directed to receptacles with matching circuit breakers while operating 12 flood-lights totaling 250,000 candle power.

Powered by a six-cylinder gas engine, the alternator provides an output of 30-kw., three-phase, 60-cycle. It is available in two models: four-wheel steerable or four-wheel tandem type of trailers with capacities from 15 to 50 kw., a.c. Source: **Weber Aircraft Corp., Industrial Machinery Div.,** 2820 Ontario, Burbank, Calif., U.S.A.

●

Nonlubricated plug valve

Pressures ranging all the way from vacuum to 20,000 psi. can be handled with a new line of nonlubricated plug valves recently put on the market, the maker says. Features cited for the valves include a noncorrosive plug as standard, line repairability, and proper balancing.

The valves come in sizes from 1 in. to 4 in. for use with air, oil, water, mud, and slurries. Source: **NWT Corp.,** 4820 Alcoa Ave., Los Angeles 58, Calif., U.S.A.

Need more facts on the items described on these pages?

The manufacturers will gladly supply them. They're shown in bold type, with their addresses. For convenience, send this coupon to the manufacturer.

ITEM _____

_____

OIL and GAS JOURNAL

May 22, 1961

NAME _____

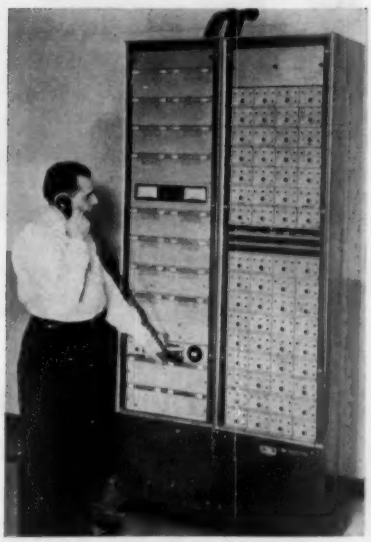
TITLE _____

COMPANY _____

ADDRESS _____

CITY _____

STATE _____



Transistorized microwave package is versatile

Incorporated in a new transistorized microwave package are new radio-frequency, multiplex, telegraph carrier, and alarm equipment. The equipment operates in the 6,000-m.c. region. All four equipment items in ithe Series 50 package incorporate modular construction and etched circuit cards. These are said to make servicing easy. Pullout drawers permit maintenance

from the front of the equipment racks.

Either a.c. or d.c. power can be used to operate the equipment. Four models of the equipment are being produced: standby, nonstandby, frequency diversity, and space-diversity models.

In the multiplex equipment, as many as 600 subcarrier channels or toll-quality voice communications are provided. The 600 channels occupy a band-width extending from 60 to 2,540 k.c., providing 4 k.c. channel spacing. Source: **Motorola Inc., Communications Div.**, 4501 W. Augusta Blvd., Chicago 51, Ill., U.S.A.

•

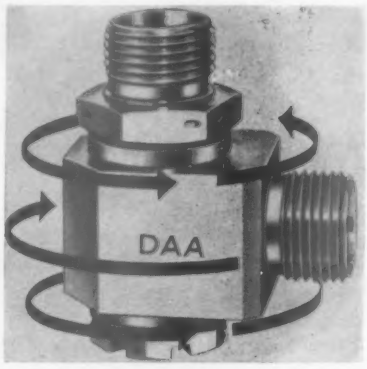
Signal source for counters

Electronic counter equipment can be operated from the signal provided by a new transmitter now available. The Model D transmitter can be used with master meters or pipe type of provers, and for blending applications and valve positioning.

It is designed to generate an alternating current, peak to peak. Voltage output characteristics are in direct proportion to meter flow rate. An exciter gear which breaks the magnetic field of a transducer generates the output signal.

The portion of the transmitter which houses the electrical circuit is of explosionproof design. Two basic units are offered. Each gives a choice of two voltage outputs. All models are designed to function accurately at temperatures from −100° to 225° F. Source: **Smith-Erie Div., A. O. Smith Corp.**, 1602 Wagner Ave., Erie 6, Pa., U.S.A.

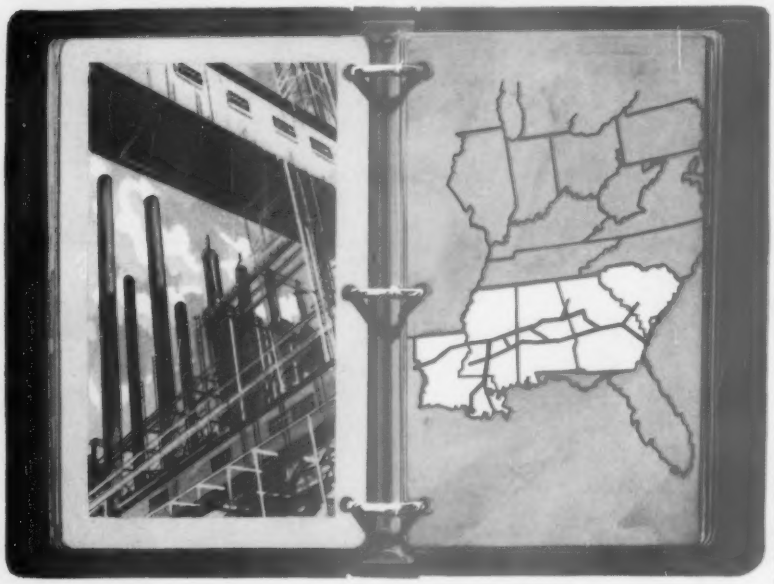
•



Swivel fittings turn easily

A torque of only 0.75 lb.-in. is required at a pressure of 3,000 psi. to turn a ¼-in.-size swivel fitting now available in a new line. The 1-in. size fitting requires less than 4 lb.-in. at the same pressure, the maker claims.

The swivel fittings are designed for use in fluid lines and can be used with most any type of flow media, the maker says. They are compact and provide 360° rotation. Source: **Dumont Engineering Co.**,



1960

Southern Natural Gas tops a decade of Growth with The Industrial Southeast

1960 was a good year for the still-booming Industrial Southeast—and for Southern Natural Gas, growing along with the region. In service to our customers—in total facilities—in revenues—the year was our best to date. Here are some highlights of Southern Natural's progress in the last ten years:

	Operating Revenues	Net Income	Dividends Paid	Daily Delivery Capacity (Million Cubic Feet)	Volume of Gas Sold (Billion Cubic Feet)
1960	$130,986,000	$11,299,000	$9,927,000	1,365	356.47
1955	69,326,000	8,534,000	5,807,000	990	264.11
1950	27,136,000	5,338,000	3,344,000	506	142.04

These results indicate a ten-year increase of about 250% in pipeline delivery capacity and volume of gas—nearly 300% in dividends. It is good to see this practical justification of our investment in The Industrial Southeast, including our recently completed expansion program, costing $100,000,000.

For a complete copy of our 1960 Annual Report, write to Department GS

SOUTHERN NATURAL GAS COMPANY

WATTS BUILDING, BIRMINGHAM, ALABAMA

Special Report to Users of Caterpillar Equipment: Custom TRACK SERVICE

Custom Track Service saves coal stripper $3298 by adding 3800 hours to track life

A coal stripper, ripping and 'dozing rocky overburden 7 days a week around the clock, was averaging 2300 hours of life before he *replaced* most of his totally destroyed track group parts. At the suggestion of his Cat Dealer, the stripper tried new, larger-size undercarriage parts. By following recommendations of the dealer's undercarriage specialist at 2440 and 4030 hours, the undercarriage went a total of 6100 hours with only pin and bushing replacements . . . and all but the shoes were rebuildable instead of scrap! Up to this point, Custom Track Service saved the stripper a $3298 cash outlay; and since he was able to rebuild the links and reuse the pins and bushings instead of replacing with new assemblies, he realized additional savings.

PAST EXPERIENCE

ALL BUT SHOES READY FOR SCRAP PILE AFTER 2300 HOURS

PRESENT EXPERIENCE

COMPLETELY REBUILDABLE EXCEPT SHOES AFTER 6100 HOURS

HOW CUSTOM TRACK SERVICE HELPS LOWER COSTS

Custom Track Service, available only from your Caterpillar Dealer, is designed to help you get the most possible service from undercarriage parts and thus cut costs. Factory-trained specialists are ready to help solve your particular track problems. They can give sound recommendations to help you get the most from your undercarriage.

They can advise you on maintenance . . . help you tailor the many special undercarriage parts and track options available to meet various job conditions. As a result, costs per hour go down and profit and machine availability go up.

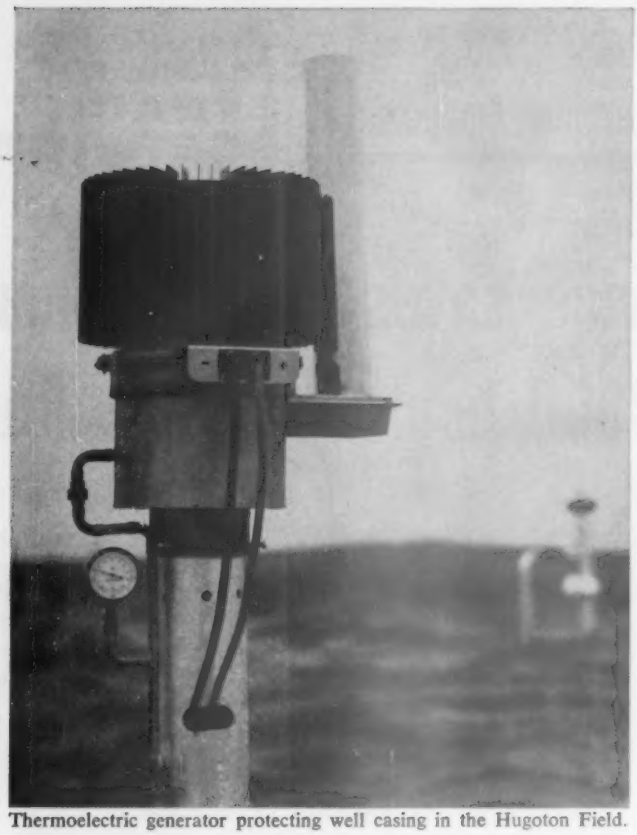
These undercarriage specialists are backed by modern track undercarriage rebuilding facilities manned by experienced personnel . . . by the largest and most complete stock of standard and special application parts available . . . by Parts Exchange Assemblies that keep tractors working and earning.

Check with your Cat Dealer and learn how Custom Track Service can help you to reduce costs.

Caterpillar Tractor Co., General Offices, Peoria, Ill., U.S.A.

CATERPILLAR

Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.



Thermoelectric generator protecting well casing in the Hugoton Field.

Again, CPS Is In There Fustest With The Mostest . . .

in the form of a field tested thermoelectric generator which is in production and available at moderate cost

As a result of the joint design and development efforts of Texas Instruments, Incorporated and Cathodic Protection Service over the past year we are happy to announce to the corrosion engineer the availability of a field-tested and proven thermoelectric generator. This unit described herein is not a laboratory model or a prototype but is a unit which is now in commercial production and is ready for practical applications of cathodic protection in the field.

This generator which has no moving parts produces currents from lead telluride thermocouples which convert heat directly to electric energy. This, the "guts" of the unit, has gone through extensive shakedown tests in the Texas Instruments laboratories for the better part of the developmental period.

The lead telluride system is built into a housing consisting primarily of a burner capable of using either natural gas or LPG as the fuel and an efficient heat dispensing unit. The complete production model of the generator has been exhaustively tested both in our shops and in an actual field installation providing current for the cathodic protection of a well casing.

To be assured of continuous operation under all types of climatic conditions in the field the burner for the production line model has been designed to withstand wind velocities in excess of 100 mph by actual test.

First attention has been given to the development of a unit of 8 watts capacity, a rating capable of covering a large number of cathodic protection applications, particularly in the field of protection of well casings. This is the unit which is in large scale production but represents only the first of a series of generators which will meet nearly all cathodic protection applications. Additional capacities will be anounced in the near future.

The present production model is particularly suitable for the protection of well casings of moderate current requirements, extensive hot spots on bare gas pipe lines, and also for furnishing supplemental power for the protection of coated pipe lines and heater treaters or other salt water handling equipment, just to name a few of the potential applications for this commercially available unit.

CPS is the sole outlet for this jointly developed unit as applied to the cathodic protection field. Contact our main office in Houston or any of the below-listed branch offices for operating data and cost information.

Cathodic Protection Service
P. O. Box 66387 Houston 6, Texas JA 6-1981

CORPUS CHRISTI
1620 S. Brownlee TUlip 3-7264

LOS ANGELES
7531 Muller St., Downey Phone TO 2-2045

NEW ORLEANS
1627 Felicity JAckson 2-7316

ODESSA
5425 Andrews Hwy. EMerson 6-6731

PITTSBURGH
4 Delmar Ct., Delmont HO 8-7513

TULSA
2570 S. Harvard RIverside 2-7393

1401 Freeman Ave., Long Beach, Calif., U.S.A.

•

Pipe and vessel insulation

A tongue-and-groove joint system is used in a new line of pipe and vessel insulation, tradenamed Vapo Lock. The insulation comes in both styrofoam and urethane. The maker claims it gives protection under a wide range of operating conditions and that it lasts for a longtime because it is resistant to mold, fungus, and sudden changes in temperature.

The product is said to operate successfully at temperatures from 220° to −350° F. in chemically corrosive atmospheres. Source: **MMM Inc.,** P. O. Box 2114, Houston 1, Tex., U.S.A.

•

New chemical permits well acidizing without corrosion

A new acid solution has been developed that is claimed to be as much as 945 times less corrosive than hydrochloric acid. According to the developer, the product can save at least 24 hours of rig time when it is used as a completion and perforating fluid, and it removes downhole scale without damaging tubing, pump, and rods when left in place.

The product, tradenamed MSA (multiple service acid), has undergone 6 months of field use in more than 200 wells. Its major advantage is the low corrosion rate which permits the acid to remain inside a well for 3 or more days with virtually no damage to metal.

When high bottom-hole pressures exist, the product can be weighted to 11½ lb. per gal. Source: **Halliburton Co.,** Duncan, Okla., U.S.A.

DARCOVA PUMCUPS

now available with

100% NYLON COMPOSITION

for HYDRAULIC CONTROLS, AIR CYLINDERS, RECIPROCATING PUMPS

Darcova Pumcup

Darcova 45°
Bevel Type Pumcup

DARLING Pumcups—long noted for unequalled efficiency and life in all kinds of cylinders—are now greatly exceeding their own performance records! The new 100% Nylon Composition, available *only* in Darcova Pumcups, does it!

Nylon Pumcups are made in sizes, types and textures exactly right for your particular equipment—ready *now* to give you unprecedented piston packing performance!

Write for helpful data Bulletin No. 5903.

DARLING VALVE & MANUFACTURING CO.
Williamsport 1, Pa.

DARCOVA
THE ORIGINAL COMPOSITION CUP

TRADE MARK
PUMCUPS

S. E. HUEY & CO.

ENGINEERS & SURVEYORS

BERNHARDT BLDG.

MONROE, LA.

SURVEYING & MAPPING

PIPE LINE SURVEYS

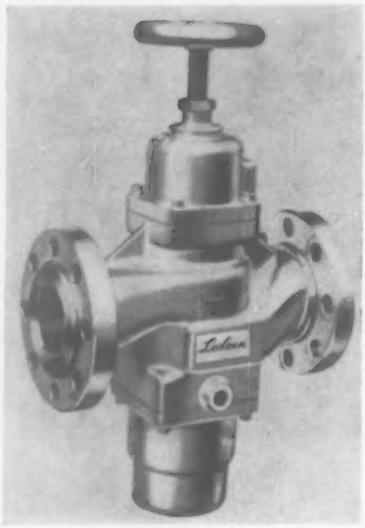
SOUR GAS?

Use a SWECO Sweetener for H_2S removal. Ideal for analyses under 50 grains per hundred cubic feet. Will clean to .01 grain per CCF. No pumps, no water, no towers, no boilers, no power required. Low initial cost. Low maintenance. Ideal for well site installation. One day to install.

SWECO

Southwest Equipment Co.

Prudential Bldg. Houston 25, Texas
Phones JA 2-5444 OR 4-8484



Shutoff valve with integral actuator

This unidirectional shutoff valve with an integral actuator comes in a straight shutoff cycle or as a shutoff valve with a downstream vent for service requiring tight shutoff of upstream pressure while venting the downstream line. The valve has a handwheel for manual operation.

The integral actuator is pressure-operated with a spring return. Two pilot-pressure ranges are available. The low-pressure range is 10 to 25 psi. This may be increased to 80 psi. when the valve is equipped with a speed restrictor. Line pressure range is from 40 to 200 psi. This may be increased to full line pressure if the valve is obtained with the restrictor. The valve is suited to both pneumatic and hydraulic service at temperatures from −40° to 250° F. Source: **Ledeen, Inc.,** 3350 N. Gilman Rd., El Monte, Calif., U.S.A.

•

Freezing-point standards

Available with National Bureau of Standards certified freezing-point samples is a line of freezing-point standards. The apparatus offers an accurate and convenient means of reproducing primary and secondary points in the International Temperature scale for the calibration of temperature-sensing devices. The standards are designed to use the methods specified in Section 3.1 of NBS Bulletin 590.

The standards come complete and ready for use with the certified metal samples contained in pure graphite crucibles, hermetically sealed to prevent contamination.

Features cited for the standards include automatic temperature control, fast warmup, long freezeout time (15 to 20 minutes), and simple operation. Source: **Temptron, Inc.,** 7030 Darby Ave., Reseda, Calif., U.S.A.

MACCO

MACCO RETRIEVABLE CM2FS-RC "SPRING" FLUID OPERATED VALVE ("No Charge" Bellows)

The CM2FS-RC is an adaptation of the conventional CM2-FS fluid operated valve with an integral reverse flow check valve. This 1½" O.D. valve is designed to be selectively retrievable from Type MM Sidepocket Mandrels. For further information, write for Retrievable Valve Brochure No. 9-01 plus Brochure Nos. 3-12 and 3-13.

MACCO RETRIEVABLE CM1FS-CK "SPRING" FLUID OPERATED VALVE ("No Charge" Bellows)

The CM1FS-CK is an adaptation of the conventional CM1 fluid operated valve. This 1" O.D. valve is constructed to be selectively retrievable from Type K-C Sidepocket Mandrels. The CM1FS-CK Valve was designed with particular emphasis on lifting multiple completions using a common annulus reservoir of supply gas.

For further information, write for Brochure Nos. 3-12, 3-13, 3-21, 3-31, and Retrievable Valve Brochure No. 9-01.

CM2FS-RC

CM1FS-CK

MACCO OIL TOOL COMPANY, INC.

1521 Prince P. O. Box 7288 Houston 8, Texas
Phone UN 1-1253

What's NEW

. . . in literature

Mechanical-anchors catalog

Corrosion-resistant anchors for pipelines, guying drilling rigs, and tanks are described in a new publication, free upon request. The catalog outlines features of the Natchez anchors, and describes a new bracket that comes complete with special polyvinyl pad and a clip-lock device. Source: **Petroleum Anchor Equipment, Inc.,** 1217 Prairie Ave., Houston 2, Tex., U.S.A.

Extreme-Line casing

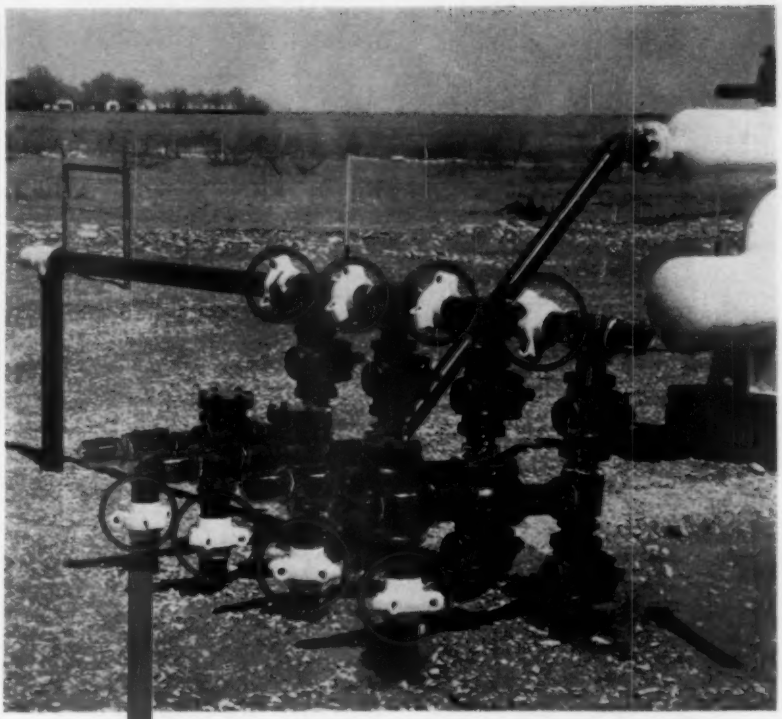
Available in sizes from 5½ to 9⅝-in. o.d., the casing is designed for deep, high-pressure wells. It is said to have a smooth external upset smaller than API couplings to permit good clearance in tight holes. The brochure gives dimensions and performance properties of the three grades of Extreme Line casing in an easy-to-read, two-page chart. Source: **Youngstown Sheet & Tube Co.,** Box 900, Youngstown, Ohio, U.S.A.

Hydraulic pumping systems

Two types of pumping installations—a fixed type and the Kobe Free Pump—are explained in detail. All components of both types are included and each element is illustrated: cutaway drawings of the subsurface pumping units, exploded views of surface power equipment, controls, wellhead equipment, tools, and service facilities. Part numbers identify each individual component and complete assemblies. The catalog contains pump-selection tables to simplify ordering. Source: **Kobe, Inc.,** 3040 E. Slauson Ave., Huntington Park, Calif., U.S.A.

Specialists important in process engineering

This 12-page booklet is another in a series concerned with "professional advancement." It depicts the value of specialization in the broad concept of the engineering profession, in which the engineer must have knowledge of the total effort of his company and the effect of his



The WECO WAY Is The BETTER WAY

When you're making up field headers and manifolds; setting separators, heaters, treaters; connecting tank batteries and making other field installations, the unions to use are WECO.

The precision pipe threads make-up easy and are leakproof. The acme threads on sub and nut make-up fast. The ball and cone seat is a positive leakpoof seal. The three lug Fig. 100 (above) can be made up with a bar or hammer.

Standardize with WECO on all your production hook-ups and field connections to simplify installation and save money on subsequent changes or additions.

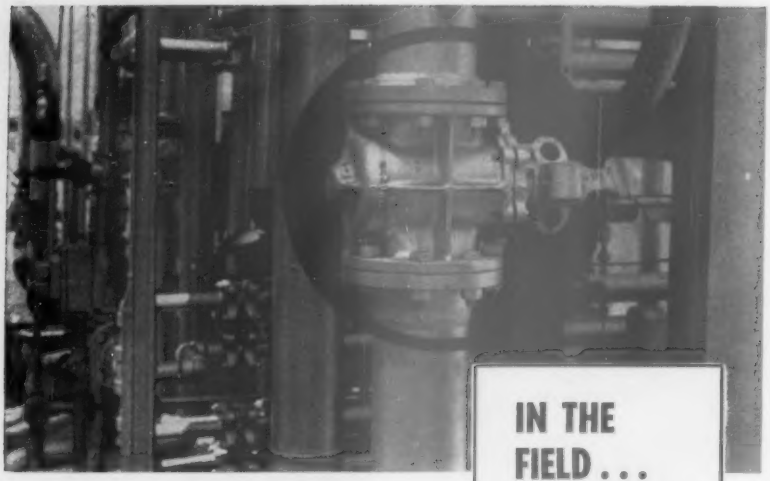
WECO Unions available from supply stores everywhere.

WECO

WELL EQUIPMENT MFG. CORP.
P. O. BOX 19465 • HOUSTON 24, TEXAS
Division of CHIKSAN COMPANY *a subsidiary of* FOOD MACHINERY AND CHEMICAL CORPORATION

U-4-61 fmc

WECO UNIONS · CHIKSAN SWIVEL JOINTS · HAMER LINE BLIND VALVES · HAMER PLUG VALVES · WECO AIR-O-UNION · WECO COMPOUNDS · WECO SNATCH BLOCKS



Here . . . in this field processing plant . . . DeZurik Valves mean peak production all of the time; there are no time-outs for costly maintenance, no product loss or contamination from leakage.

In the refinery . . . DeZurik Valves exhibit these same superior characteristics. In short, they'll prove out on your most difficult service. Try them!

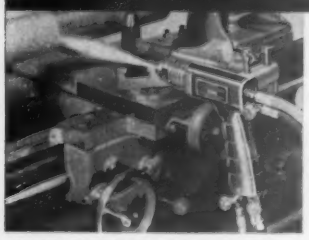
The DeZurik representative in your area can give you all the details, or write to

DeZURIK CORPORATION
SARTELL, MINNESOTA

IN THE FIELD . . . OR IN THE REFINERY . . .
DeZURIK VALUES DELIVER

"Curses! There's COLMONOY hard surfacing everywhere!

Even on NEW washpipes!"



The Colmonoy Spraywelder applies powdered nickel-base alloys smoothly and quickly. Overlays are fused and ground.

Washpipes in hydraulic jarring tools take about the worst "wear and tear" of any oil field equipment. That's why Bowen Itco, Inc., hard surfaces its washpipes with Colmonoy No. 6. Colmonoy overlays resist corrosion/abrasion, do not gall, have a low coefficient of friction—thus provide oil field parts (new or old) with longer life.

Why don't you try Colmonoy alloys and methods to solve your problems of excessive wear? Request the Spraywelder Catalog and Hard Surfacing Manual No. 79. We can also recommend a shop doing Colmonoy work near you.

HARD-SURFACING & BRAZING ALLOYS

WALL COLMONOY CORPORATION
19345 JOHN R STREET • DETROIT 3, MICHIGAN

Buffalo • Chicago • Houston • Los Angeles • Morrisville • New York • Pittsburgh • Montreal • London, England

specialty on the profit structure of the company. The 4 by 8½-in. publication demonstrates how the engineer of today can become the profitably productive specialist of tomorrow, through five methods of self-development. Source: **Heat Exchanger Div., Western Supply Co.,** Box 1888, Tulsa, Okla., U.S.A.

Frac-Notch and triple Frac-Notch cutters

Technical Service Report T-4101 (4 pages) introduces the cutters which use a new single-plane entry method of fracture initiation for hydraulic fracturing. The literature illustrates a new cutting process used by these tools to cut and fracture the formation on a horizontal plane as much as 15-in. deep outside the casing. The publication offers drawings, advantages, applications, and specifications. Source: **McCullough Tool Co.,** 5820 S. Alameda St., Los Angeles 58, Calif., U.S.A.

Water-flood flow rates with new setting table

The wallet-size, plastic Reddi-Rate setting table contains flow-rate values compiled specifically for use with the maker's 504 Five Pointer Meter registers. These registers have sweep hands with dial readings graduated for a 1/10-bbl. input per revolution. By timing the number of seconds per revolution, a quick glance at the setting table tells you the flow rate in barrels per day. Source: **Petroleum & Industrial Meter Div., Rockwell Mfg. Co.,** 390 N. Lexington Ave., Pittsburgh 8, Pa., U.S.A.

Engineering guide for carbon-graphite materials

Designed for various types of mechanical applications, the materials are illustrated and described in eight-page Bulletin S-5425. It presents grade recommendations for seals and sliding surfaces for a wide range of liquids and gases at operating temperatures up to 500° F., above 500° F., and in the cryogenic range. The bulletin tabulates 18 grades of carbon, graphite, and carbon-graphite, and lists properties for each grade. Source: **National Carbon Co.,** 270 Park Ave., New York City 17, N. Y., U.S.A.

▶▶▶ Equipment Men Notes

Lone Star Steel Co. receives

. . . American Public Relations Association's Silver Anvil for Lone Star's 1960 public - relations program. Recent presentation of the "anvil" was made to L. D. (Red) Webster, vice president—public relations and advertising, in Atlantic City, N. J. The APRA recognition program names only one winner in each of several categories. Lone Star was judged best among the nation's manufacturers.

R. C. Booth becomes vice prexy

. . . in charge of sales of Plastic Applicators, Inc., and transfers to the firm's general offices in Houston. A member of the firm's board of directors, Booth was previously vice president in charge of West Texas operations. He joined Plastic Applicators in 1956, after serving 8 years as a corrosion engineer with Shell Oil Co. He became manager of the West Texas area in 1957 and a vice president the next year.

Cooper-Bessemer purchases

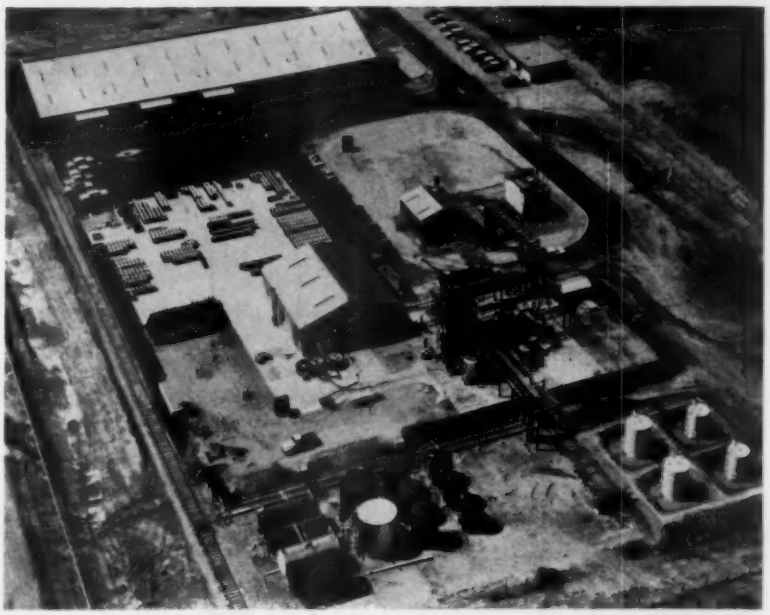
. . . Kline Mfg. Co., Galena, Ohio manufacturer of hydraulic pumps and motors. Kline's business will be carried on as a wholly owned subsidiary of Cooper-Bessemer, and the company will retain its present name. No changes are expected in the company's management or location of plant facilities. William L. Kline will remain as president.

J&L Supply expands substore

. . . at Trenton, Neb. into a full line supply store, according to Rainey Elliott, president. The store was opened in April 1960 as a substore of the division's Sterling, Colo. store. J. A. Baker has been appointed store manager.

Harris, Festervan are appointed

. . . as representatives by Oil Well Supply Division of U. S. Steel Corp. James R. Harris takes over as district representative at Pawhuska, Okla. Ellis P. Festervan assumes a field-representative post at Houston.



ORGANIC-CHEMICAL-PROCESSING PLANT of Dowell Division of The Dow Chemical Co. started operations this month. The plant, located in Tulsa, will blend, mix, and process chemicals to produce products used in Dowell services to the industry. These include acid and corrosion inhibitors, agents to prevent or reduce fluid loss, friction loss, surface tension, water blocks, and agents for the consolidation of loose sands, flocculating agents, and other products. The plant is composed of five buildings—a process center, raw-material storage, drum storage, and finished-product packaging and storage. Included on the 12½-acre tract are a warehouse, drumming building, boiler house, instrument-control building, office, reactors, distillation tower, cooling tower, storage area, and buildings for hazardous storage.

Fred R. Ellenberger is elected

F. R. Ellenberger

. . . vice president of international operations by Worthington Corp., succeeding S. Riley Williams who retired. The Harrison, N. J. manufacturer has 15 plants in 13 countries outside the United States. Ellenberger joined Worthington in 1938 as secretary to Hobart C. Ramsey, now chairman of the corporation. Subsequently he served in a number of domestic assignments before joining the company's export division in 1946. Ellenberger became vice president and general manager of Worthington (Canada) Ltd. at Brantford, Ont. in 1955. He returned to company headquarters last year as assistant vice president of international operations.

Nordberg Mfg. Co. appoints

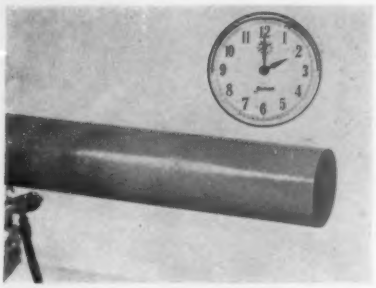
. . . Tom Young as a special Engine Division sales representative in Louisiana with headquarters in the New Orleans office, announces R. W. Bayerlein, vice president of Nordberg's Engine Division. Young will assist in the application and sale of Nordberg diesel engines, reporting directly to W. J. Moran, New Orleans district manager.

Robert J. Mullenbach is named

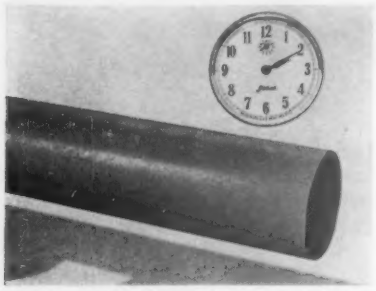
R. J. Mullenbach

. . . general manager of Electric Machinery Mfg. Co.'s Control Division. This new position results from moving the control department of E-M into larger facilities and reorganizing it into a division. Mullenbach will be responsible for all activities of

Dimetcote® is now SELF-CURING!



Only one spray coat of Dimetcote No. 4 is required. No primer! No curing solution!



Dimetcote No. 4 self-cures in a matter of minutes. Completely non-flammable and non-hazardous both during and after application. All the proven corrosion protection and weather resistance of Dimetcote No. 3 — plus self-curing.

As soon as dry, Dimetcote can be handled the same as bare steel. If severe abuse should cause minor abrasions, the zinc content cathodically prevents rust.

Dimetcote No. 4 is a self-curing maintenance version of Dimetcote No. 3, the original inorganic zinc silicate coating in use since 1938.

- The 1-coat, 100% inorganic zinc silicate that is equal or superior to galvanizing
- Completely self-curing
- Non-flammable, non-hazardous both during and after application
- Excellent abrasion resistance and toughness
- Cathodically protects steel
- Insoluble in all petroleum products

The dry film of Dimetcote No. 4 is the same as Dimetcote No. 3, which is the most widely used and most successful coating of its kind. Used alone or as a permanent primer, Dimetcote No. 4 gives steel structures the same long-lasting protection against severe atmospheric exposure!

Technical data available on request.

Amercoat® CORPORATION

4809 Firestone Boulevard
South Gate, California

921 Pitner Ave.
Evanston, Ill.

111 Colgate Ave.
Buffalo, N.Y.

360 Carnegie Ave.
Kenilworth, N.J.

2404 Dennis St.
Jacksonville, Fla.

6530 Supply Row
Houston, Tex.

1348

AMERCOAT NO. 99—When required for severe chemical exposures, Dimetcote plus Amercoat No. 99 provides a revolutionary 2-COAT system!

Amercoat No. 99 is a high solids vinyl that easily attains a 6-mil dry film thickness in one airless spray coat . . . a 5-mil thickness in two coats by conventional spray methods; forms a tough, flexible film with excellent chemical and weather resistance.

Tests prove the Dimetcote/Amercoat No. 99 two-coat combination outperforms other maintenance systems—even those requiring up to 5 coats!

the new division, including engineering, manufacturing, and sales. He will report directly to A. P. Burris, E-M president.

Mueller Co. names Frank Speer

F. A. Speer

. . . as vice president and works manager, according to Jackson Kemper, executive vice president of the Decatur, Ill., manufacturer. Formerly manager of the New Castle, Pa. plant of Chicago's Crane Co., Speer will direct manufacturing operations for all Mueller domestic facilities.

Reynolds Metals Co. promotes

W. B. Moore, Jr.

. . . William B. Moore, Jr. to general manager of the south-central sales region with headquarters in St. Louis. He also was elected vice president of Reynolds Aluminum Sales Co. The announcement comes from William T. Ingram, general sales manager, at the company's headquarters in Richmond, Va.

R. H. Etnyre named works mgr.

. . . at the Houston plant of National Supply Division, Armco Steel Corp. He succeeds George S. Leonard, who resigned. John O. Miller has been named works manager at National Supply's Gainesville, Tex. plant, succeeding Etnyre. Russell A. Priest takes over Miller's previous job as chief industrial engineer at Gainesville.

Black, Sivalls & Bryson makes

. . . three appointments, according to Paul Bartley, sales vice president for the Kansas City manufacturer. Edward W. Reif has been named sales manager of the Mid-Continent region; Thomas F. Casey, Jr. has become account executive for the same region; and William H. Moody has been appointed resident manager of the Tulsa sales office.

Reif formerly served as product sales manager for controls and specialty products. For 8 years he was

IN MIAMI... IT'S

THE Columbus HOTEL

Biscayne Boulevard at First

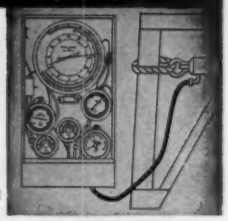
Luxurious accommodations... superb cuisine... impeccable service... distinctive decor — these are The Columbus, Miami's distinguished downtown bayfront hotel... choice of discriminating travelers the world over.

Reservations:
Your Travel Agent, or
write The Columbus—Miami

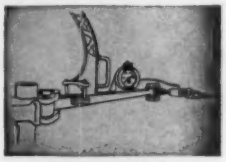
TOP O' THE
Columbus
Miami's distinguished dining rendezvous

TONG TORQUE

THE MARTIN-DECKER
TONG TORQUE ASSEMBLY
FOR ALL CONNECTIONS



PERMANENT INSTALLATION
The cylinder attached to the back-up line provides torque indication each time collars are run.



PORTABLE INSTALLATION
The torque assembly attached to the tong itself can be used for spot checks on two or more rigs.

ONE GAUGE for torque measurements of all size drill collars, drill pipe, tubing and casing.

ACCURATE AND RELIABLE readings with calibration checks seldom required.

CARE AND MAINTENANCE can be capably done by the drilling crews.

MARTIN DECKER

WRITE FOR DESCRIPTIVE LITERATURE
MARTIN-DECKER CORPORATION, DEPT. P-6A
3431 CHERRY AVENUE, LONG BEACH 7, CALIF

Wherever dependable gas gathering is done you will find

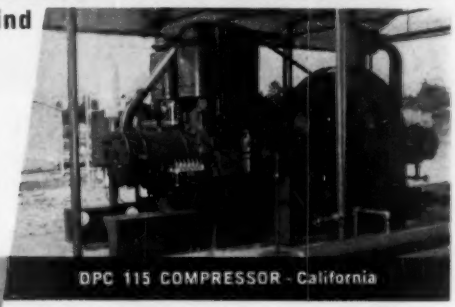
AJAX

SIMPLE DESIGN • LONG-LIFE

COMPRESSORS

TRUSTWORTHY — UNATTENDED OPERATION

BACKED BY 83 YEARS OF AJAX ENGINE BUILDING SKILL — Your mechanic can repair it if he can repair an AJAX ENGINE.



DPC 115 COMPRESSOR - California

AJAX IRON WORKS CORRY, PENNSYLVANIA
Oil Field Distributors
- The National Supply Co. — Pittsburgh, Pennsylvania
- Bethlehem Steel Co. — Supply Division, Tulsa, Oklahoma
- Mid-Continent Supply Co. — Fort Worth, Texas

W. C. NORRIS

Target
SAVINGS THRU QUALITY
FITTINGS

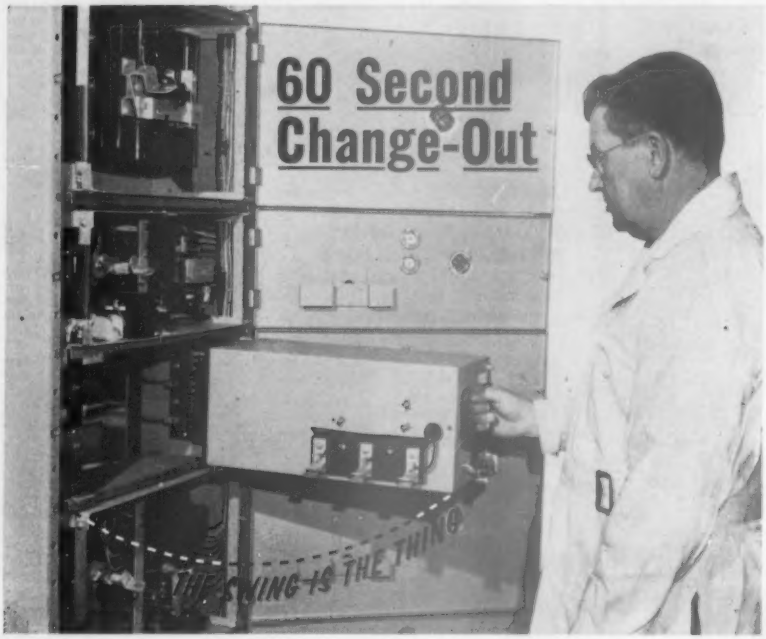
WRITE FOR NEW FITTINGS BULLETIN
P. O. BOX 1739, TULSA

It's All NEW . . . In Concept In Application

Automatrol

► FROM NELSON

The First Motor Control Center Specifically Designed for use with Automated Systems



60-seconds or less is all the time required to change-out a starter or circuit breaker in the new Nelson AUTOMATROL motor control centers.

No tools, no specially trained personnel are required. You simply open the door, release the safety latch, swing the unit out and lift it off the pin hinges. You install the new unit just as easily. What could be more important when production is stopped?

This is only one of many new features found in Nelson AUTOMATROL motor control centers that are designed specifically for automation systems. For complete information write for Bulletin 2001 or call your local Nelson representative.

BIG ENOUGH TO PERFORM — SMALL ENOUGH TO CARE

NELSON *Electric* MANUFACTURING CO.
TULSA, OKLAHOMA

P. O. BOX 5385 NATIONAL 7-5530

district sales manager for oil-field equipment in the Permian Basin. Reif joined BS&B in 1942.

Casey, who has been with the company since 1946, will serve the region as product advisor to the regional manager for control equipment besides handling executive sales. Moody joined BS&B in 1952 as a process engineer and served as chief applications engineer and product supervisor for gas-process equipment prior to his new appointment.

Wide, Inc. chartered in Houston

. . . to provide manufacturers with domestic and foreign sales representation. The company will devote its attention to the sale and marketing of products used in drilling, producing, pipeline, and processing plants, thereby relieving the manufacturer of these operations. In addition, Wide, Inc. will assist in product development, market surveys, and anaylsis, and will serve as sales consultants on both domestic and foreign sales problems.

W. H. (Bill) Griffin, in charge of foreign sales, started in the oil fields as a driller and later specialized in

W. H. Griffin

F. O. Richards

various types of well completions. He has served in various executive capacities with Baker Oil Tools, Inc., Camco Gas Lift, Welex Jet, Johnston Testers, and was a director, executive vice president, and general manager of Hardy-Griffin Engineering Corp.

Frank O. Richards, in charge of domestic operations, is initiating area representatives and engineers throughout the United States. Richards was general sales manager of Texsteam Corp. for 7 years and for 13 years preceding that position he was vice president and sales manager of Bettis Corp. Lyal W. Hetrick, executive vice president, is in charge of the general offices in Houston. He has served as vice president of McFarland Mfg. Corp. the past 14 years.

MATHIESON
Sulfuric Acid

H_2SO_4

ECONOMIC ANALYSIS

Reliable cost figures depend on many factors relating to your individual location and requirements. Part of Mathieson's responsibility is the development of realistic figures for you in this area.

DEPENDABLE SUPPLY

Strategic locations assure you fast delivery of all commercial grades of sulfuric acid from our plants and shipping points in Beaumont, Port Arthur, Pasadena, Texas ... Little Rock, Ark. .... Bossier City, La. .... Baltimore, Md.

ACID RECOVERY

Dependable outlets for spent acid can be as important as acid supply. Olin Mathieson's long experience in spent acid handling determines our recommendations for the most advantageous disposal of your spent material.

SAFETY

New operations, new employees ... you will need complete safety and handling instructions. We supply these in both literature and wall chart form.

TECHNICAL ASSISTANCE

Your Olin Mathieson man knows the petroleum field and the chemical industry. His on-the-spot knowledge and our laboratory facilities and experience are at your disposal. For product specifications or service, call or write: OLIN MATHIESON, Balto., 3, Md.

Ammonia • Carbon Dioxide • Caustic Soda • Chlorine • Hydrazine and Derivatives • Hypochlorite Products • Methanol • Muriatic Acid • Nitric Acid • Soda Ash • Sodium Bicarbonate • Sodium Chlorate • Sodium Chlorite Products • Sodium Methylate • Sodium Nitrate • Sulfur (Processed) • Sulfuric Acid • Urea

Olin

CHEMICALS DIVISION

8956

DT

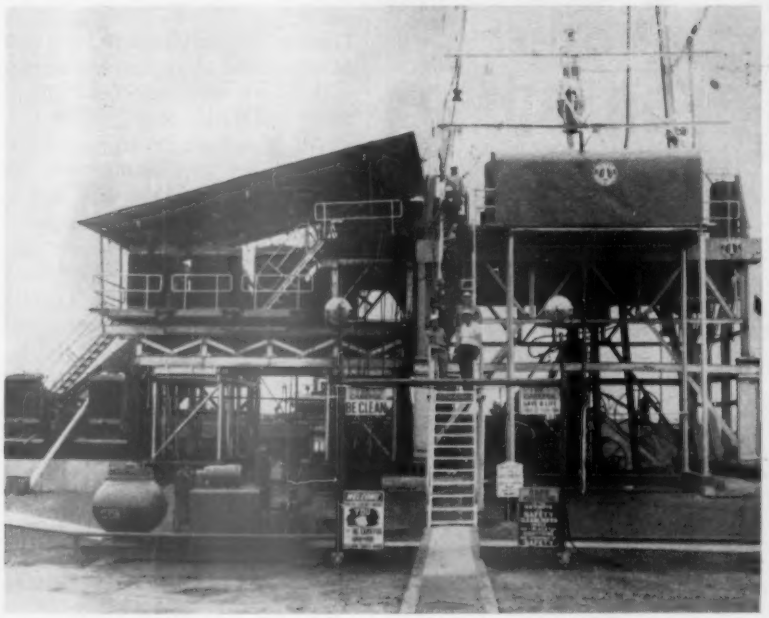
Designed for Soft Formations

SMITH TYPE DT 3-cutter rock bits are designed and constructed to insure rapid rates of penetration in moderately soft to soft formations . . . sturdy, deeply cut and widely-spaced teeth . . . optimum self-cleaning properties are provided by the widely-spaced teeth in combination with ample tooth deletions and efficient flushing action of the circulating fluid.

OUR 25th YEAR

Smith TOOL CO.

COMPTON, CALIFORNIA
Branches in Principal Oil Centers Throughout the World



Safety stressed

DEEPENING OPERATION for Gulf Oil Corp. is working below 14,771 ft. in the Anadarko basin. Venture is Gulf 1 Hartley C NE NW 34-14n-26w, Roger Mills County, Oklahoma. Tools used are Parker Drilling Co. Rig 54. Location is just west of Reydon townsite, 3 miles from Texas line. Parker stresses safety and clean rigs evidenced by the manicured site. Personnel (from top and left) are: H. D. Benefield, driller; Raymond Strong, Eugene Townsend, G. E. McMasters, and P. D. Salsman, crewmen; Don Johnson, Gulf geologist; Walter Reek, Gulf drilling foreman; and W. D. Lang, Parker tool pusher.

Contractor orders first aluminum drill pipe

TOOL JOINTS are being put on the first string of aluminum drill pipe to be tested by a drilling contractor. Reynolds Metals Co. recently announced that Prime Drilling Co. of Wichita has ordered a 5,250-ft. string of the light-weight metal. The pipe will be used to drill wells in the McCook, Neb. area.

Shell Oil Co. has tested aluminum drill pipe in the Gulf Coast area during the past 6 months and during that time more than 75,000 ft. of hole was drilled without failure, nor were any problems encountered (see OGJ, Dec. 12, 1960, p. 102 ff.) The testing done by Shell was the culmination of a 6-year effort by Reynolds.

Prime Drilling will use the new drill string on a Brewster rig rated at 7,000 ft. According to C. A. Prichard, president of the drilling firm, the aluminum is expected to cut moving costs, will upgrade the rig for drilling deeper depths, lower power costs, and require fewer men to handle the pipe.

Although aluminum drill pipe is not yet available commercially, the anticipated savings during the test period are contributed to the light weight. Aluminum weighs about half that of steel pipe and can be handled with appreciably less power.

Another advantage is the fact that the smooth bore of the aluminum pipe will reduce friction loss resulting in better drilling hydraulics and greater pump efficiency, claims Prichard. The size of the pipe ordered is 4½-in. and the tool joints are standard "Super Shrink-Grip" made by Reed Roller Bit Co. of Houston.

Mohole ship back at work

THE CUSS I, which was used last month to drill in 12,000 ft. of water as part of the Mohole project, is back on the job of drilling for oil.

The 260-ft. vessel is working for

Dowell Paraffin Solvent . . . a low-cost solution to an expensive problem

Dowell Red Paraffin Solvent is a non-chlorinated, oil-soluble material designed to dissolve paraffin accumulations . . . even when complicated by asphalt, salt, sand, gum or wax. Dowell solvent is chemically neutral. It contains no acid.

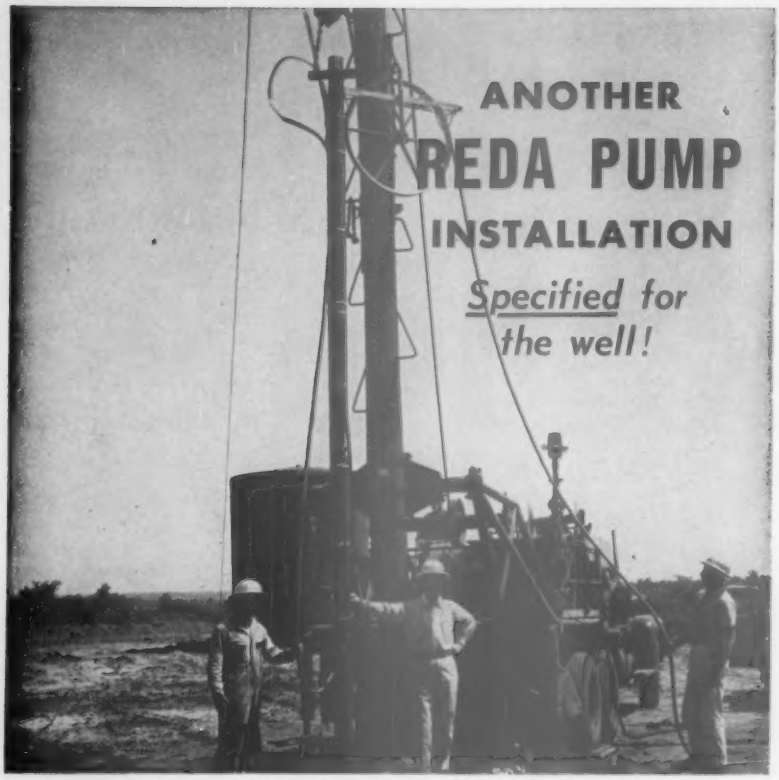
Dowell Red Paraffin Solvent weighs 10.4 pounds per gallon. It is often used at its full concentrated strength. However, it may be diluted easily with kerosene, gasoline, benzene or xylene to provide an effective, low-cost solvent for specific paraffin problems.

Dowell Paraffin Solvent is available at all Dowell stations and many oil field supply stores in convenient 10-gallon steel drums.

PRODUCTS FOR THE OIL INDUSTRY

DOWELL

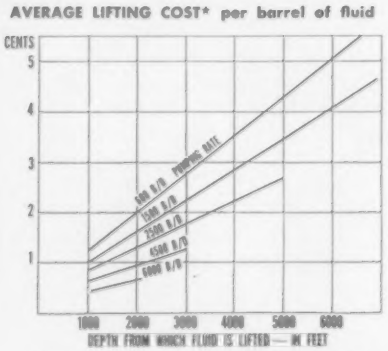
DIVISION OF THE DOW CHEMICAL COMPANY



REDA Does the Job Better and at LOWER COST

Billions of barrels of fluid (oil and water) have been produced at an average lifting cost of less than one cent per barrel for each 1,000 foot lift. Chart "A" illustrates average lifting cost from 600 B/D to 6,000 B/D using Reda Submergible Pumps.

Most complete submergible pump line for producing oil wells, water supply wells, brine wells, etc. Sizes range from 5 to over 240 h.p. . . . models for wells cased with 4", 5½", 6⅝", 7" or 9⅝" casing . . . for depths from 500 to 10,000 feet, and for capacities of 100 bbl. to over 18,000 bbl. per day.



*Included: Electric Energy (10 Mills Per KWH), Run and Pull, Repairs, Upkeep, Transportation, Labor and Amortization (8 Yrs.)

Chart "A"

Write for Descriptive Folder R-686 Today

REDA PUMP COMPANY / BARTLESVILLE, OKLAHOMA

Manufacturers of Submergible Electric Motors & Pumps for over 40 years
Pumps for Oil, Brine, Water, Gasoline, Jet Fuel, Chemicals, LPG

SIGN OF QUALITY SUBMERGIBLE REDA PUMPS

Standard Oil Co. of California off Santa Barbara County. The ship is drilling in 235 ft. of water in the Gaviota area on one of the two wells Standard of Cal. expects to complete with a new underwater completion technique (OGJ, May 1, p. 59).

All of the special equipment developed for the Mohole job has been removed and the drill ship restored to an oil-well drilling vessel. Normal drilling procedure also is being followed. On the Mohole core holes, salt water was used as drilling fluid and the rotary rate held down to 40 r.p.m. Regular drilling mud and rotary speed are being used for the Gaviota well.

The Standard of California assignment is the fourteenth in oil exploration for the CUSS I, which is owned and operated by Global Marine Exploration Co., Los Angeles.

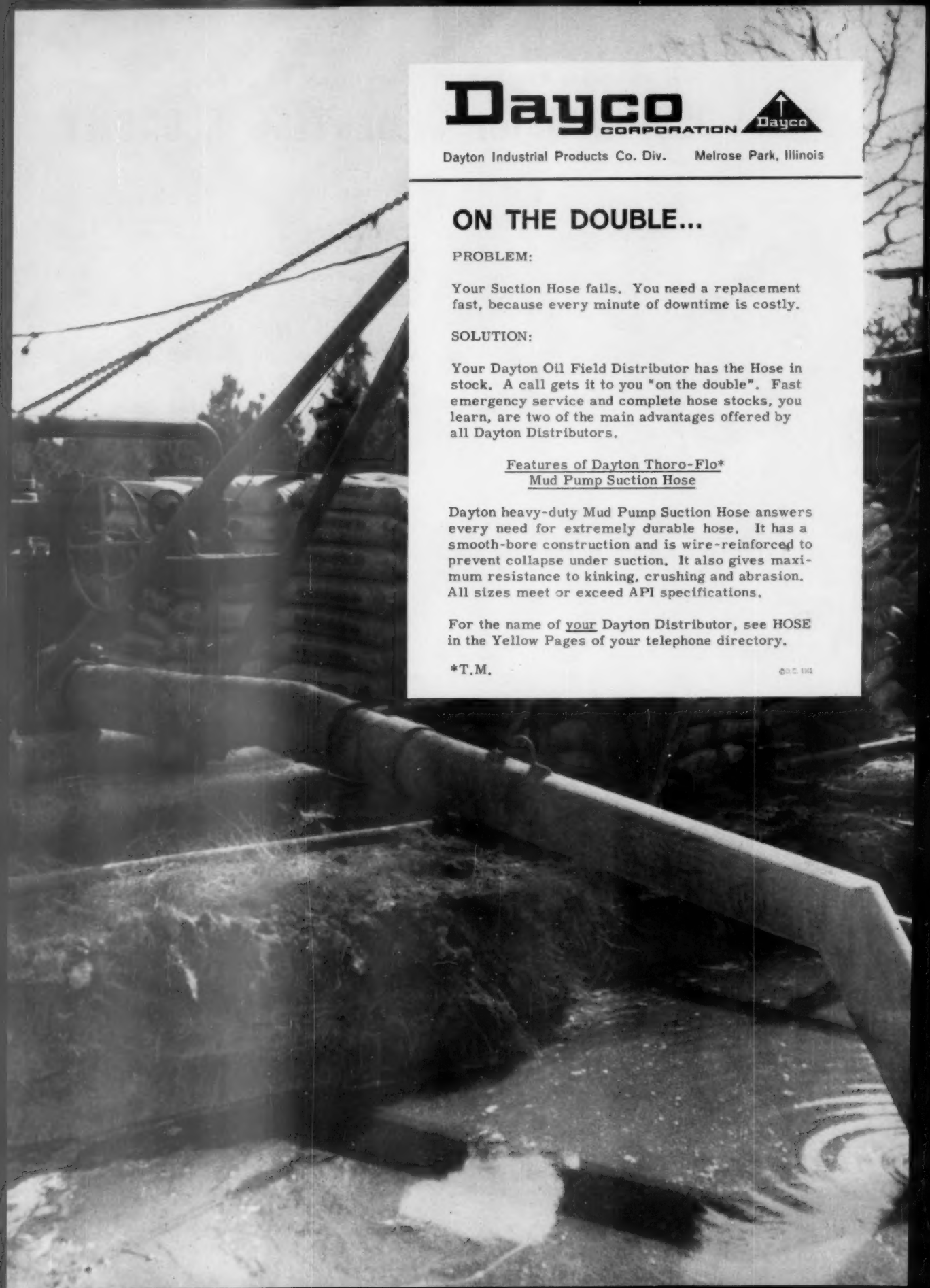
Greater Cha Cha area stirs

A NEW AREA in the Four Corners sector of the Rocky Mountains is stirring with activity. Development is going on at the Cha Cha field in northwestern New Mexico's San Juan County.

Lying on the west edge of the vast Blanco gas area, the discovery well at Cha Cha was by Pan American Petroleum Corp. in 21-28n-13w. After drilling to the Dakota the well was plugged back to the Gallup where it was completed as a pumping well with 95 bbl. of oil per day through perforations at 5,508-5,685 ft. This well didn't create too much interest until Benson, Montin & Greer Drilling 2 Jones was completed for 132 bbl. of oil per day, 2 miles northwest of the Pan American well. Five additional development wells were completed forming the initial outline of Cha Cha.

Along this northwest - southeast trend, El Paso Natural Gas Co. attempted a Dakota well, the 1 Ojo Amarillo, to the northwest in 27-29n-14w. The Dakota failed to produce and the well was plugged back to the Gallup where it flowed 304 bbl. of oil per day at 5,320 ft.

Subsequent development by El Paso, Humble, and Pan American greatly enlarged the Cha Cha producing area.



Dayco CORPORATION

Dayton Industrial Products Co. Div. Melrose Park, Illinois

ON THE DOUBLE...

PROBLEM:

Your Suction Hose fails. You need a replacement fast, because every minute of downtime is costly.

SOLUTION:

Your Dayton Oil Field Distributor has the Hose in stock. A call gets it to you "on the double". Fast emergency service and complete hose stocks, you learn, are two of the main advantages offered by all Dayton Distributors.

Features of Dayton Thoro-Flo* Mud Pump Suction Hose

Dayton heavy-duty Mud Pump Suction Hose answers every need for extremely durable hose. It has a smooth-bore construction and is wire-reinforced to prevent collapse under suction. It also gives maximum resistance to kinking, crushing and abrasion. All sizes meet or exceed API specifications.

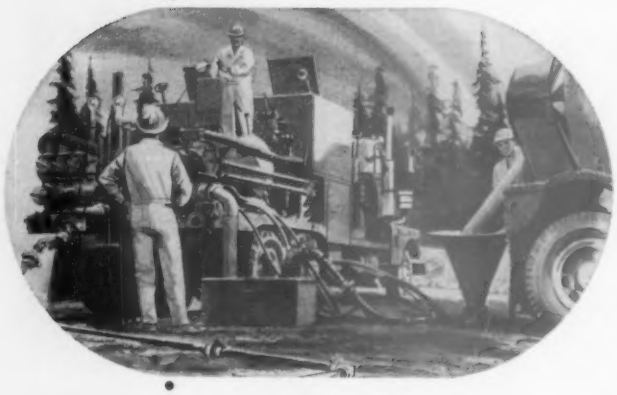
For the name of your Dayton Distributor, see HOSE in the Yellow Pages of your telephone directory.

*T.M.

©D.C. 1961

TWO PROVEN HALLIBURTON FLOAT VALVES

DESIGNED for CEMENTING ECONOMY



SAVE ON INITIAL COST

SAVE TIME IN RUNNING CASING

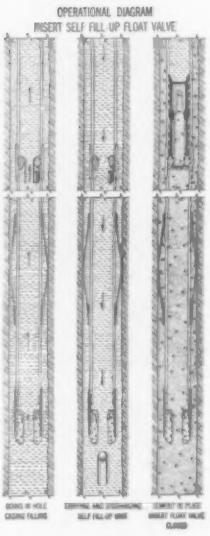
SAVE EXCESSIVE DERRICK STRAIN

SAVE ON DRILL-OUT TIME

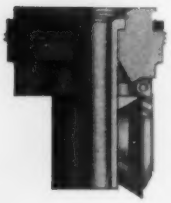
INSERT FLOAT VALVE

This Halliburton tool is low in cost, simple in design and efficient in operation. Installed by a short thread inside the casing coupling and sealed between the casing ends, no length is added to the string. Eliminates two threaded connections for each valve used in the string.

Designed for use in wells where a medium range of differential pressures exist, the assembly consists of a readily-drillable cast aluminum body, flapper valve and spring and two rubber sealing rings. The stout spring helps hold the valve closed during floating-in and after cementing is completed. This tool is excellent for use with a "DV" Multiple Stage Cementer.



INSERT SELF FILL-UP FLOAT VALVE



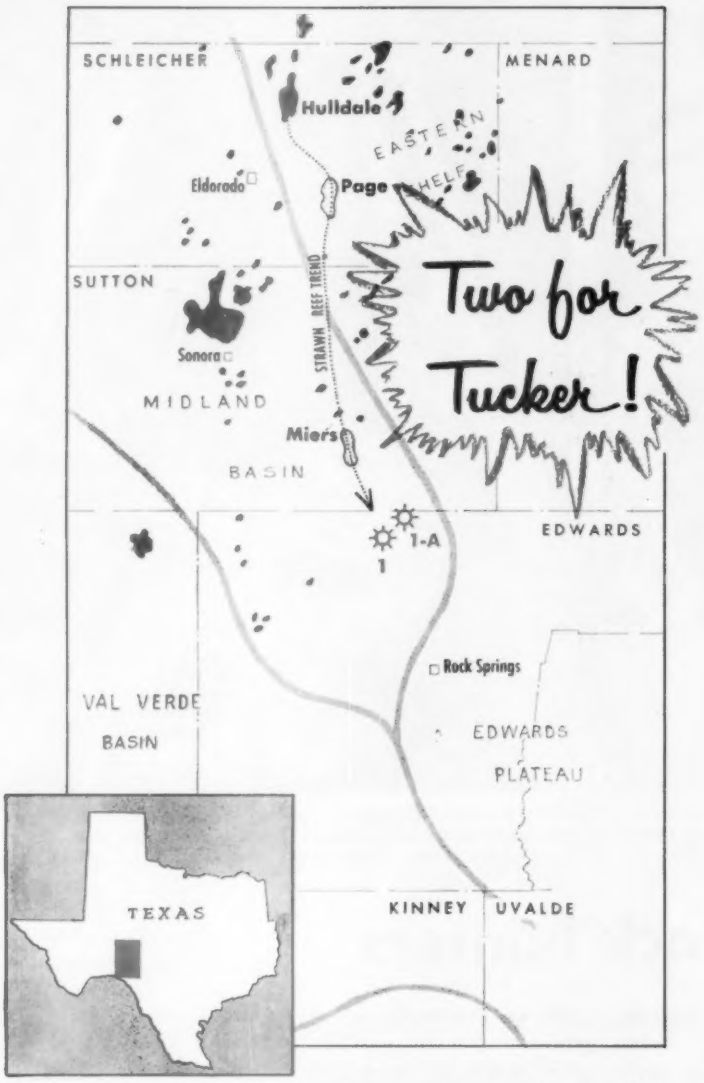
A combination of the Insert Float Valve described above and a simple self fill-up assembly incorporating a plastic orifice tube, the Insert Self Fill-Up Valve was designed for use in filling casing in areas where field conditions sometimes interfered with other fill-up devices. See illustration. A preselected, special size orifice tube holds the valve open allowing the casing to fill going in the hole. When the casing is within a few joints off bottom, a weighted plastic ball (furnished) is dropped and seats on the valve. After reaching casing point, pressure is increased to break the orifice out of its seat. The plastic flow tube and ball drop through the guide nose to the bottom. The valve then closes and acts to help keep cement in place after the cementing operation.

ASK your local Halliburton Representative about these proven valves. He will help you select the proper unit to match your well's requirements.

CEMENTING SERVICES

"TOOLS AND EQUIPMENT TO MATCH THE JOB"

Halliburton
COMPANY • DUNCAN, OKLAHOMA



THE ALMOST OIL AND GAS-DRY southeast corner of the Midland basin picked up two Cisco Pennsylvanian gas discoveries in a daring bid to unravel the mysteries lying below the Cretaceous section.

Southwest Texas' Paleozoic pays only await the drill

BY FRANK J. GARDNER

AT ONE fell swoop, a Texas driller scored a double whammy in a county that has defied oil hunters for 50 years.

Tucker Drilling Co., Inc., and G. H. Coates last week released discovery details on two gas strikes in northern Edwards County, Texas, 21 miles northwest of Rock Springs, and thrust this on-again, off-again county into the producing column once more.

Drilling on the big Miers ranch, Tucker et al. actually finished the 1 Miers in mid-December 1960, and the 1-A Miers in January. But completion dope was withheld until now. Both discoveries are flowing gas from the Cisco-Pennsylvanian section between 2,200 and 2,400 ft. The 1 Miers was gaged for 3,000 M.c.f. gas per day (absolute open flow), and the 1-A for 2,120 M.c.f.

The importance of these two gas wells springs from only one factor—depth. Few wells in Edwards County have gone deep enough to test the Paleozoics. Every drop of oil that has dribbled from the county (total 33,449 bbl. from four abandoned fieldlets) has come from Glen Rose-Lower Cretaceous, and all from depths of 200-600 ft. The area simply has not been fairly explored.

Deep Try in 1930

One of the deepest holes in Edwards County was drilled by Phillips Petroleum Co. on the Holman ranch near the Sutton County line in 1930; it went to 8,230 ft. It found the top of the Pennsylvanian at 3,485 ft. and top of the Ordovician at 7,565 ft.; this test, 20 miles west of the Tucker discoveries, had shows of oil at 550-60 and 925-40 ft., and shows of gas at 4,070-78, 4,980-85, and 5,325-35 ft., but ended up dry.

Tucker carried the 1 Miers to 6,220 ft., and plugged back to 2,485 ft. for completion through perforations at 2,364-76 ft. The 1-A went to 6,023 ft., but was completed at 2,222-36 ft. The operator is mum about tops of formations, other tests, etc. But he has proved that the much-disturbed pre-Cretaceous section of this Edwards Plateau country has much to offer in the way of undiscovered oil and gas. These Paleozoic formations are believed to be strongly folded and faulted, much as they are in the Midland basin to the northwest.

The Strawn reef trend of Sutton and Schleicher counties points directly toward the Miers wells. The implication is clear that Edwards County has much more in store.

NO OIL RIGS LOOM in Chuck Rowett's future. This Oklahoma University student will go into teaching and research upon completion of PhD work in paleontology. Fig. 1.

PROSPECTIVE GEOLOGISTS like Dan Dugan are facing an employment situation entirely different from the one which greeted graduates a few years ago. Fig. 2.

New fields for rock hunters

• Geology curriculum is branching out to keep pace with a changing industry

BY DR. CARL C. BRANSON
Chairman, Department of Geology
University of Oklahoma, Norman

A FEW YEARS AGO, the ink was hardly dry on the geologist's diploma before he found himself the most sought-after of college graduates. In many cases, he had the job lined up long before he got the degree. His grades, aptitude, and training made little difference. If he could accumulate enough hours to graduate, high-paying employment was practically automatic.

Oil companies were desperate for men. They didn't have time to wait for the MS or the PhD. They didn't feel that they could even afford to be too particular about the men they were hiring with only bachelor's degrees. They needed petroleum geologists immediately, and it was left to the schools of geology to supply them. Many of those we supplied were capable, well-qualified geologists; many were not.

Then the bottom dropped out of oil production—and it's no secret what happened to the jammed geological staffs of the oil companies. The marginal geologists—those with only bachelor's degrees and inadequate training—suddenly found themselves without jobs. And those just emerging from geology schools were faced with a choice between working outside geology or not working at all. The oil industry had an unfamiliar problem—unemployment. It was a shock, but not a totally unexpected one to the staff of the School of Geology at the University of Oklahoma.

For several years, the School of Geology had been studying a change in the curriculum, a shift of emphasis which would better prepare our graduates for a wider range of employment. The tremendous demand for petroleum geologists had made this approach impossible before domestic oil production was curtailed. Since that time it has become man-

datory that we do something in this direction.

Our new course of study for the bachelor's degree, which goes into effect in September, does not deemphasize petroleum geology. Instruction in petroleum geology will always be a vital part of the O. U. School of Geology. But if we are to best serve the petroleum industry, and our students as well, we must turn out graduates who are thoroughly grounded not only in geology but in the fundamental sciences that are basic to every phase of geology. By slightly reducing the number of hours of geology required for the bachelor's degree, we have allowed for more work in the allied sciences, which will include mathematics through integral calculus, 12 additional hours in physics, chemistry, and the biological sciences, and 6 to 7 hours in related fields such as engineering and the history and philosophy of science.

Conditions Change

Along with this strengthening of the curriculum, the School of Geology is experiencing a great change in teaching conditions—a situation which had become almost unmanageable at the peak of the oil industry's employment boom.

At that time in our more advanced geology courses, where the maximum in individual instruction and attention is demanded, our professors were handling several sections of the same courses with as many as 90 to 100 in each section.

On the undergraduate level, we had an even more difficult situation confronting us. The glittering opportunities in the oil industry were attracting many who were not really gifted in the field. The low employment standards encouraged laziness on the part of the student geologists. Why should they exert themselves for an "A" when barely passing was enough to get them the job they wanted? For those with real ability, the advantages in going on to graduate study were overshadowed by the money to be made immediately without the time, expense, and drudgery of graduate work.

Then came the cutback in oil production, which started in the country about 3 years ago, the effects on employment opportunity reaching Oklahoma about a year later. Those students already studying geology, for the most part, completed their work rather than change majors; therefore the big drop in enrollment is being felt this year.

Degrees Granted

In 1950 O. U. granted 235 bachelor of science degrees in geology and 73 in geological engineering. By 1958 the number of bachelor degrees was down to 125 geologists and 43 geological engineers. This year we expect 50 degrees in geology and 16 in geological engineering. With the prospect for employment considerably dimmer, the number of sophomores entering the School of Geology dropped drastically—which will inevitably lead to a condition in which demand will again exceed supply, but at a lower level.

We feel that the adjustments in our curriculum will help solve this problem by giving our graduates preparation in many areas of geology largely neglected by O. U. before the decline in the oil industry. Before this decline 95% of O. U. geologists went into the oil business. Now only 65% are being absorbed by the oil companies. If the balance wish to remain in geology, they must be prepared to go into such allied areas as geochemistry, carbonate petrography, palynology, groundwater geology, clay mineralogy, teaching, and research laboratories.

Research Labs

The oil companies themselves are setting up extensive research laboratories which will be manned by the highly trained geologist. For these research posts, as for other positions throughout their companies, they will be demanding the better quality geologist—and they will be able to pick and choose among the candidates. The students who are serious about geology are aware of this. There will be little laziness in their approach to a profession in which they must compete for every job available.

The importance of graduate study in geology education has increased enormously. While undergraduate enrollment has dropped, the number of candidates for the master's degree at O. U. has remained about the same and the number of PhD candidates has grown. The professional (or hiring) level in geology, which was the bachelor's degree a few years ago, is now the master's degree, whereas the teaching level is the PhD. Some time ago we increased the difficulty of the graduate program, requiring in-state students to have a 2.75 over-all grade average, and out-of-staters, a 3.0 to go into graduate study. They must pass an advanced geology test.

To supplement the stronger schedule of subject matter which the School of Geology will be offering its students, we will now be able to supply them with all the equipment necessary for teaching and research. Acquisition of this equipment, required by the great increase in instrumentation in geology in recent years, has been virtually completed with the help of oil companies and the National Science Foundation.

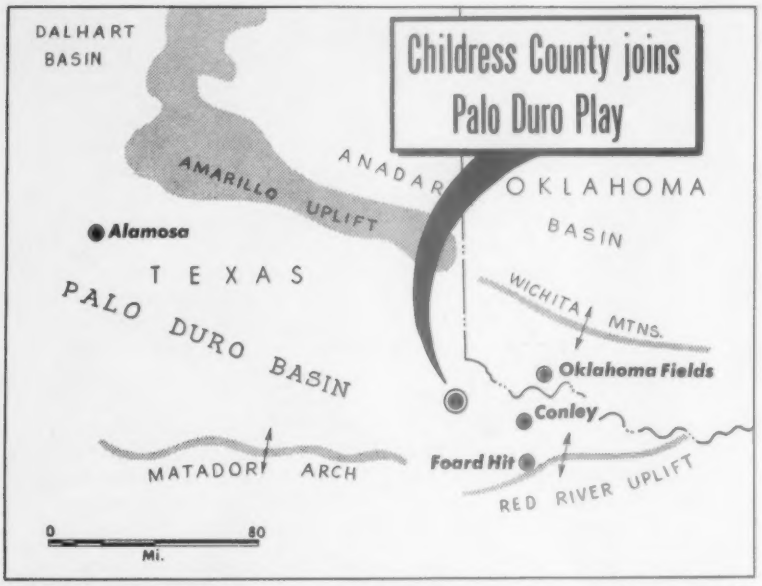
Standards Improve

The improvement in curriculum and facilities in geology education at the University of Oklahoma corresponds directly to the improvement in standards demanded by geologists all over the country, both those in education and those in industry. They are coming to the realization that a large part of the profession's difficulty in adjusting to the unemployment problem stems from the shallowness of education which geologists have been requiring for professional standing.

Dr. Lewis G. Weeks, president of AAPG, summed it up back in 1959 when he said: "Too long we have been content with mediocrity. We all know that many take geology because of inadequate capacity to handle chemistry, physics, physical chemistry, mathematics, dynamics, etc. Yet these disciplines are basic to a really sound understanding of geology, of geologic processes of every kind, and of geologic environments, an understanding of which is fundamental to every conceivable process in earth science."

This is the attitude which has been lacking for too long within our profession. It is also the attitude which the University of Oklahoma intends to reflect in the training—and educating—of today's geologist. Turning out a large quantity of graduates in geology is not enough. It never has been—unless each of the graduates fulfills in every way the highest standards which we can maintain.

—Courtesy Sooner Magazine.



ANOTHER TEXAS COUNTY has entered the producing column—Childress. A wildcat near the town of Kirkland promises new oil for the east end of Palo Duro basin.

Second Palo Duro strike may spark new interest

THE SECOND DISCOVERY this spring in the east end of Texas' Palo Duro basin may well herald a much-needed reentrance into this nearly dry exploratory arena. Newest promise of oil production for the last wildcat frontier in northwestern Texas is a wildcat in Childress County, 3½ miles southeast of Kirkland townsite in the southeast corner of the Panhandle.

Two since Conley. R. D. Gunn of Wichita Falls found Cisco Pennsylvanian production at 1-A E. V. Perkins in the southeastern corner of Childress County. A drill-stem test in the lime at 4,588-99 ft., open 40 minutes, surfaced gas in 25 minutes and recovered 900 ft. of free oil and 300 ft. of mud-cut oil. Location of this Childress County production reopener is in Section 382, Block H, Waco and Northwestern Railroad Survey.

Another oil discovery for this far-eastern corner of the long east-west Palo Duro basin is Kewanee Oil Co.'s 1 Sandifer, 4½ miles east of Crowell in Foard County, North Texas. This wildcat had good recoveries from Strawn Pennsylvanian at 4,260-4,320 ft. Recovery was 3,700 ft. of free oil, 167 ft. mud-cut oil, 52 ft. heavily oil and gas-cut mud. Operator is drilling ahead at this wildcat which is located 20 miles southeast of production at Raspberry field. It also lies 20 miles south of new multipay Conley field in Hardeman County, the best producing area in the Texas portion of the basin.

Kewanee's well lies on the very edge of the Red River uplift, the eastern boundary of Palo Duro basin.

Conley grows. Conley multipay field in Hardeman County is the best oil find in Palo Duro yet. There are nine wells drilling in and around the field, a Pennsylvanian, Cambro-Ordovician, and Mississippian producer opened in 1959. Shell Oil Co. opened Conley field with 226 bbl. per day from Chappel-Mississippian at 7,800-8,008 ft. Since then Palo Pinto Pennsylvanian, Ellenburger, and Osage Mississippian oil pays have been found. The new field with its flush producers has attracted widespread attention to the potential of this forgotten nook of Texas. Now with Childress County and Foard County both getting into the push, Palo Duro may fall into the success line this year.

North Texas' Montague has new oil producer

Boedecker, Southeast Viola lime is the name for a new field in North Texas' Montague County, 2 miles west of Bowie. The discovery well is Jack Grace Production Co. 1 Skinner & Jackson, 1½ miles southeast of nearest Viola Ordovician oil at Boedecker Viola field.

The well flowed 792 bbl. of 46°-gravity oil daily through 15/64-in. choke from perforations at 7,106 ft. Location is in Section 2858, TE&L Survey, A-786.

Gaines County. In West Texas, Texaco Inc. completed 1 N. B. Birge as a new Strawn producer in southeastern Gaines County, 14 miles east of Seminole.

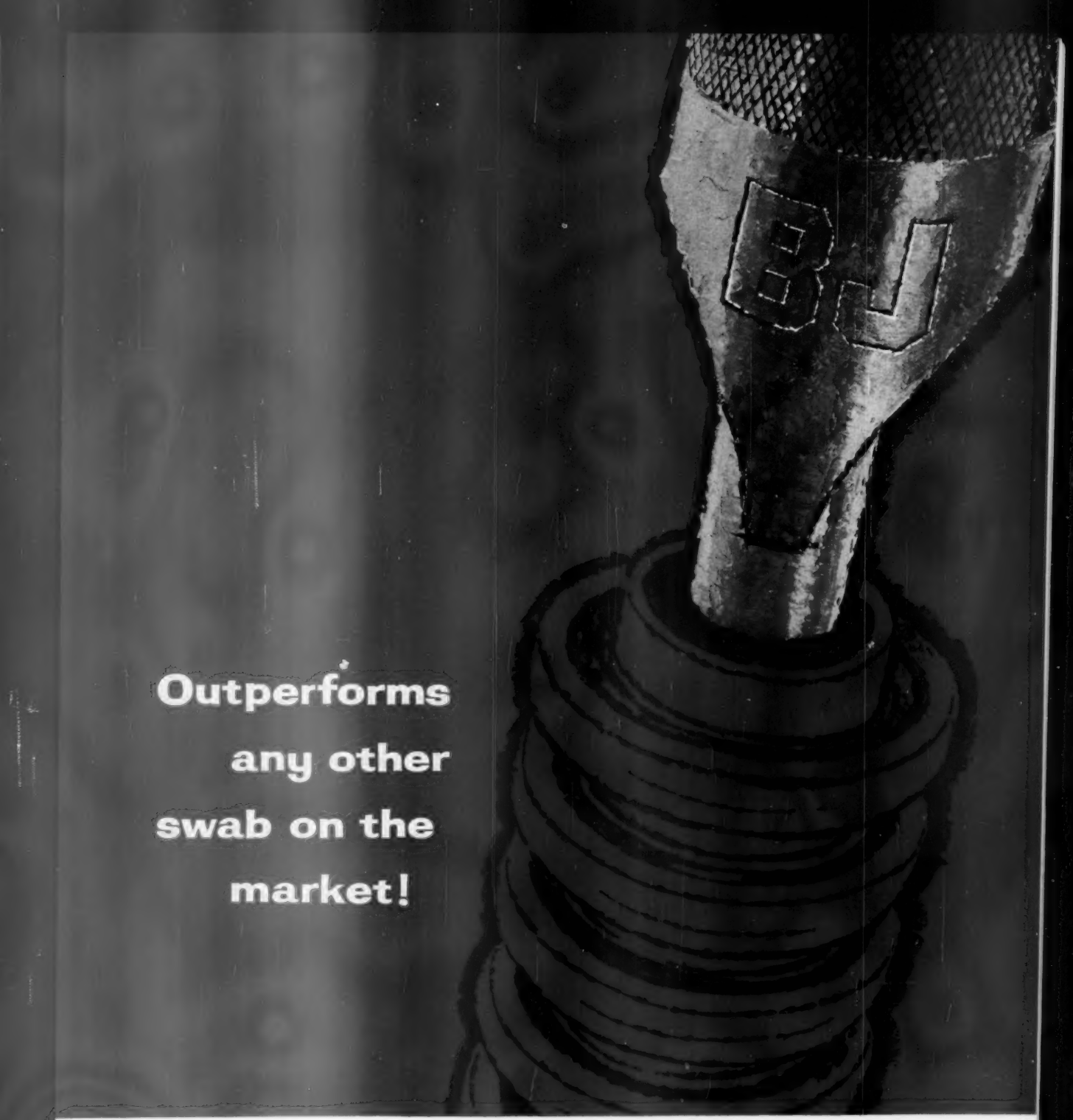
The well flowed 596 bbl. of oil per day through 6/64-in. choke. The well also made 5 bbl. of water per day. Gravity of the oil is 42.4. Production was through perforations at 11,069-80 ft. Location is in Section 1, Block C-43, PSL Survey.

Viola is new pay in North Texas area

The Viola Ordovician is a new pay discovery at Clyde J. Brannan, Jr. 1 Bert Dimock, 3¾ miles south of Bowie in Montague County, North Texas. Discovery well flowed 240 bbl. per day on 16/64-in. choke from perforations at 6,686-6,710 ft. Location is in the I. Garner Survey, A-287.

Nearest production is 1¼ miles southeast in Marinamag Conglomerate field, a Pennsylvanian producer. New field will be called Brannan Viola Lime field.

West Texas. Jack Herbert Devonian is a new field in Upton County, discovered by Gulf Oil Corp. at McElroy Ranch Co. "L," 13 miles east of Crane. The well flowed 112 bbl. of oil daily plus 16% water from perforations at 11,044-11,248 ft. through 20/64-in. choke. Location is in Section 109, Block D, CCSD&RGNG Survey. Nearest Devonian production is 2 miles southeast at Amacker-Tippett Devonian field. The operator will also dually complete the discovery in the Pennsylvanian zone.



Outperforms any other swab on the market!

BJ Tubing Swabs put more fluid in your tank in less time, with fewer rubber replacements. In rugged field use, BJ Swabs have consistently outperformed all other swabs under all conditions—shallow wells and deep ones, light loads and heavy ones, and pulling oil, salt water, gassy loads and sand-laden fluids. Over and over again, Operators who have used them say that BJ Swabs are "the best swabs" they've ever used—that BJ Swabs "fall faster...lift more...last longer." It will pay you to make your own field test of this superior Byron Jackson product. Your choice of BJ disc-type (illustrated) or cup-type swab rubbers for all standard tubing OD's—at leading supply stores everywhere. Your BJ Field Representative will gladly give you full details and proof of performance.

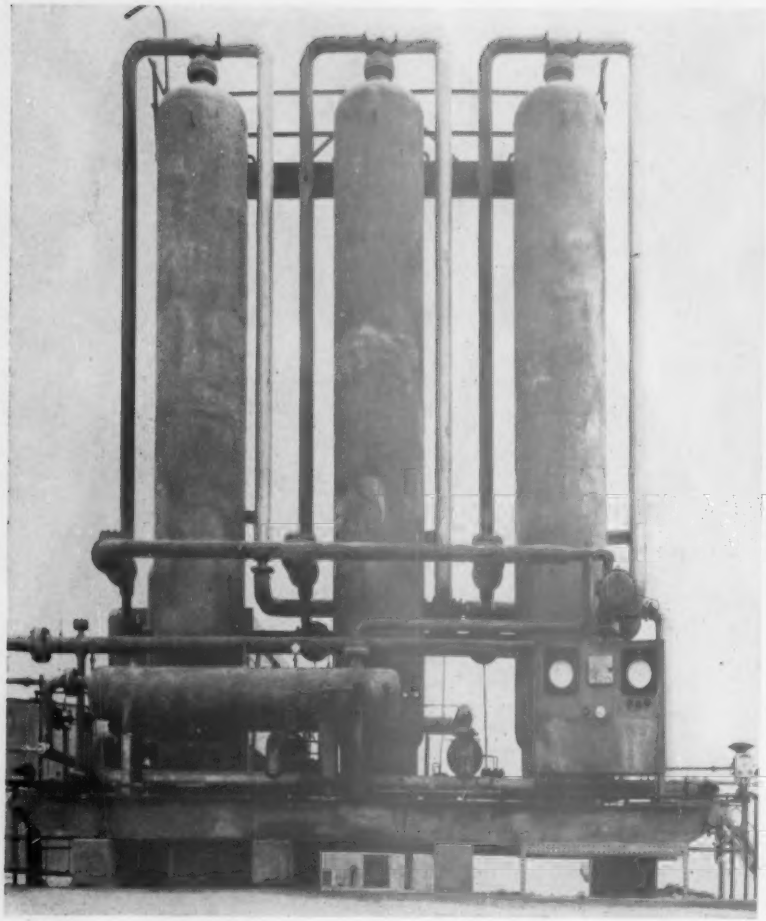
BJ

QUALITY COSTS LESS IN THE LONG RUN

Byron Jackson Tools, Inc.

A SUBSIDIARY OF BORG-WARNER CORPORATION

P.O. Box 2017-A, Terminal Annex, Los Angeles 54, California • Export Address: 580 5th Avenue, Suite 510, New York 36, N.Y.



Hy-Sorb's Dependability Means More Earnings

This latest Maloney-Crawford Hy-Sorb three-tower recovery unit is designed for 23 MMSCF/D and 150 B/d of 14# stabilized R.V.P. product. This productivity can be accomplished with 18-minute cycles and M-C's special pre-cooling feature. One of the reasons for the high output is the Hy-Sorb's over-all dependability. A major factor in this dependability is the simplified control system which operates the entire plant from the panel shown at right in the photo. The Hy-Sorb can be operated automatically or manually, and a single selector switch controls all functions of the three towers. This unit is installed on Mustang Island, off the Texas coast, and is dimetcoated for weather protection. Another Texas operator reports that a Hy-Sorb, installed downstream from cold separation, has increased his stock tank liquids 22%. Let us give you more information on how the Hy-Sorb can increase your income from gas streams.

Maloney-Crawford

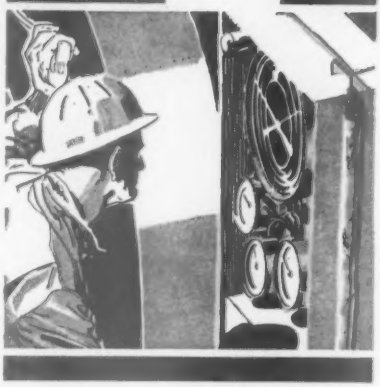
Box 659 **Tulsa**

WHEN YOU ENCOUNTER EXCESSIVE TORQUE, DRAG OR THE HAZARD OF STICKING DRILL PIPE AND CASING....

SOUTHWESTERN

92

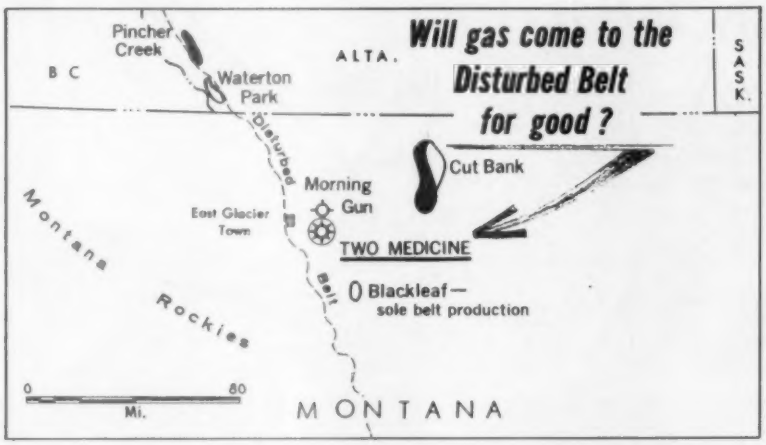
FLAKE GRAPHITE



excellent dry lubricant • inert • compatible with any mud • mud rheology unaffected • mixes readily • inexpensive • minimum graphitic carbon 92% • durable, weather-resistant 50-lb. bags

SOUTHWESTERN GRAPHITE COMPANY

GRAPHITE ROAD • BURNET, TEXAS



MONTANA'S in-and-out of the news Disturbed belt may have its second producing area at Two Medicine in Glacier County.

Disturbed belt search revives

Despite the huge gas reserves being successfully tapped in the southwest corner of Alberta, Montanans thus far have only two gas discoveries to their credit on the same disturbed east front of the Rockies.

THE INCESSANT but unsuccessful struggle to find production in northwestern Montana's Disturbed belt is once more under way.

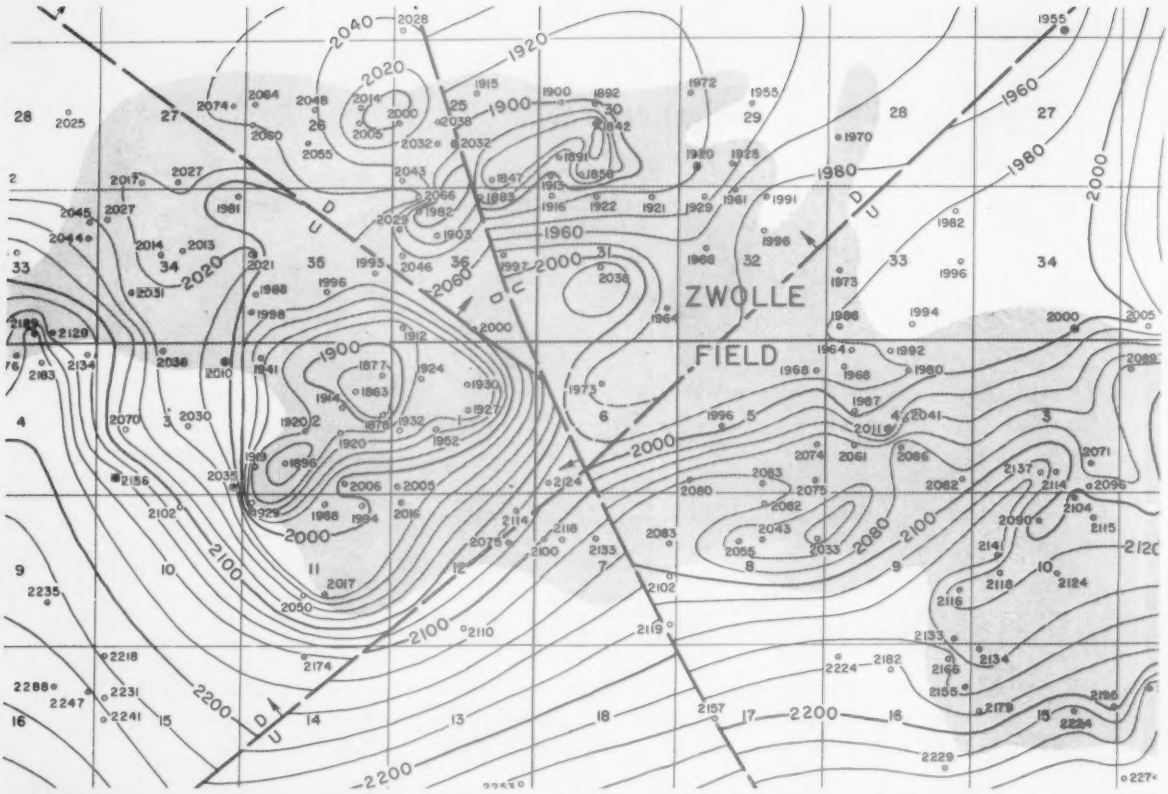
This oil and gas hunt just east of the mountain front of the Montana Rockies has been going on for many years. Everyone thought the long trek was going to pay off back in 1955 when Union Oil Co. 1 Morning Gun flowed 250 bbl. of condensate and 6 M.M.c.f.d. from Madison Mississippian. Excitement dropped, however, when Morning Gun fizzled out and was abandoned at 9,556 ft. Each year since then when spring returned to the Disturbed belt, so returned the wildcatter. For 3 long drilling years explorers plugged one wildcat after another until 1958. Northern Natural Gas Producing Co. finally gave the highly complex belt its first real producer at 1 Blackleaf-Federal. That discovery flowed 6,297 M.c.f.d. from the second Madison Mississippian overthrust at 3,830 ft. This well was carefully drilled step by step from the day the seismic crews first passed over the area. A subsequent southeast offset try was also successful, but it only flowed 969 M.c.f.d. from Madison at 5,300 ft. This was in 1959.

Another new hope. Of four wells drilled in Montana's Disturbed belt last year, only one had any signs of becoming a possible producer. This was Great Northern Drilling Co.'s 1 Two Medicine unit, SE NW 19-31n-11w, Glacier County. After several tests the well was shut in. Testing was resumed early in May and now it looks like we may have a producer, just ½ mile south of the ill-fated Morning Gun wildcat. The Two Medicine well flowed at the daily rate of 2 M.M.c.f. and 42 bbl. condensate from Madison perforations at 8,855-8,993 ft. Successful completion of this wildcat as a commercial producer would certainly revive interest in one of the hardest exploratory arenas in the field.

South of Giants. No one has quite figured out why Alberta's tremendous Foothills belt gas fields won't extend across the border into Montana's Disturbed belt. Lookout Butte, Waterton Park, Pincher Creek, and Turner Valley fields, all among western Canada's gas majors, lie just across the line. Yet deep wildcats immediately south of the border have met with failure. Superior Oil Co. tried to change this dismal picture last year at 23-19 Blackfeet-Tribal, 3½ miles south of the line in Glacier County's northwestern corner. Madison was topped at 12,404 ft., but shows were minor. They quit and left the hole at 12,705 ft.

It's true that the Disturbed belt has proved to be a real challenge for explorers—but so have the Delaware, Val Verde, Arkoma, Alaska, and a whole procession of tough ones. Superior's wildcat was drilled only 8 miles southeast of Lookout Butte and on a similar structural anomaly. They gambled on another Lookout Butte. Great Northern gambled on its Two Medicine wildcat, and may have won. As long as big fields like those in southwestern Alberta stay on the map, Montana's Disturbed belt will hear the drill. No one thinks that the big gas reserves just stop at the border, even though a few deep dry holes stand as mute testimony.

—John C. McCaslin



HERE IS A PORTION of "The oil fields of northern Sabine Parish, Louisiana," included in Bulletin 34. Shown is Zwolle field. Contours are on base of Porters Creek formation. Interval is 20 ft.

New Louisiana map available

THE Louisiana Geological Survey has published Bulletin 34, The Geology of Sabine Parish, by Dr. H. V. Andersen, Research geologist for the survey and Associate Professor of Geology at L.S.U.

Sabine Parish is located in West Central Louisiana on the south flank of the Sabine uplift. The excellent outcrops and the wide age range of formations exposed make the parish the best place to study Louisiana geology. Sabine is the key to Louisiana geology. The Angelina-Caldwell flexure and the Fisher fault cross the southern part of the parish. Geological units exposed in the parish range from Wilcox group of Paleocene-Eocene age to Recent sediments in the stream valleys. The Wilcox is exposed here better than anywhere else. In the early 30's, Sabine was one of the leading parishes in the state's oil production. However, production has declined and in recent years activity has been light.

SE Alberta has important strike

IN CANADA Zapata Canadian Petroleum Corp., wholly owned subsidiary of Zapata Petroleum Corp. of Midland, Tex., has made a discovery of notable importance in the general Hussar district of southeastern Alberta.

Flush flow rate on the well indicated that it could very well be placed on production at a rate of 50 bbl. per hour—a rate of 1,200 bbl. per day. The well is now producing at an Conservation Board-allowed 50 bbl. per day. The venture was drilled on lands acquired under farmout agreement from the Canadian Pacific Railway's Oil & Gas Co.

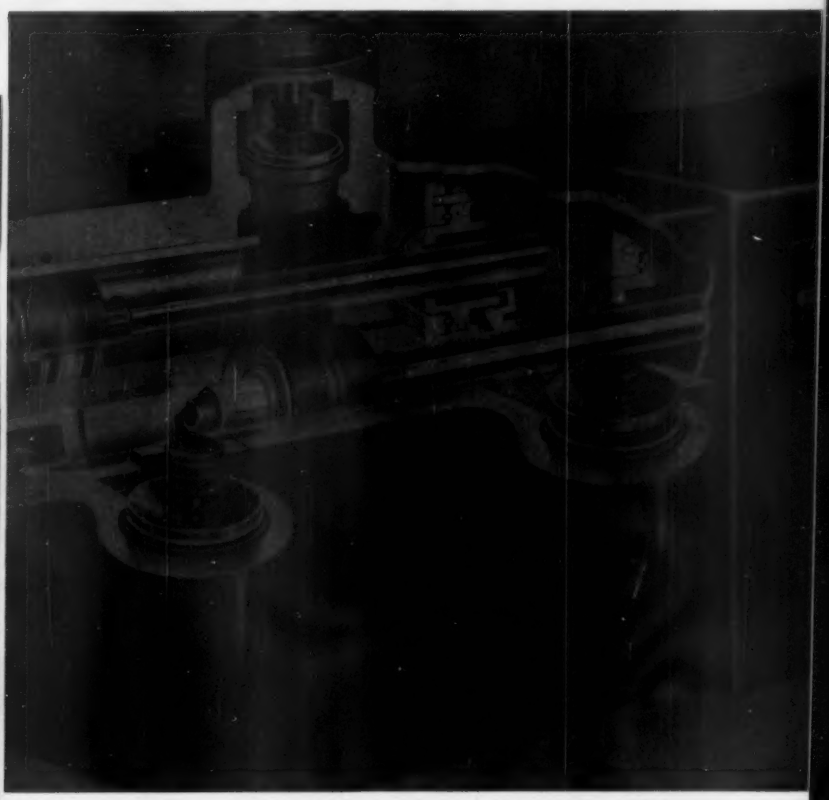
Glauconitic. The strike was made in the Glauconitic sandstone at a location only 1 mile west of natural-gas success in the district and 1¼ miles northeast of a venture in which Zapata participated which found oil in the Mississippian at a very marginal rate.

The Glauconitic, while quite prolific when found oil or natural-gas bearing has very rarely developed into sizeable pools. However, Zapata plans considerable development of an exploration program around its newest success and only the drill bit will reveal how extensive this new one is. In fact, Zapata has already staked its first new drill site in the district since discovery and it will at least define the area for a distance of 2 miles to the northwest.

This discovery well, Zapata-

put them all together

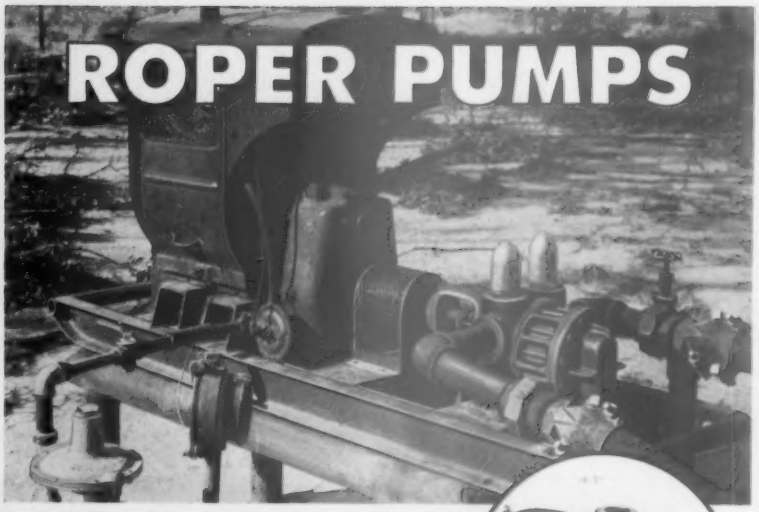
they spell higher pumping efficiency even when worn



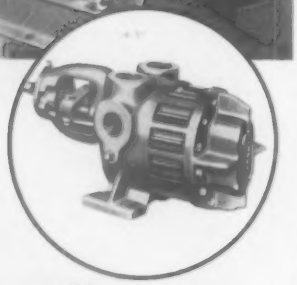
The Mud Monarch® for high pressures lasts longer and does a better job to the very end. The important thing to remember about the Mud Monarch valves and seats is the exclusive seal ring. This seal ring is unaffected by wear on both valve and seat. There is no fluid slippage, no imperfect closing due to sand or foreign material. For low and medium pressure pumps, Mission Super-Service® and Silver Top® valves will last longest. Their heavy forged alloy steel bodies have high corrosion fatigue strength and are able to resist cyclic stresses set up by loading and unloading. The Compound 308® inserts offer greatest resistance to the chemical and abrasive effect of the fluid. For any pressure, any pump, Mission pump parts are the industry's first choice for longer life, less trouble.

MISSION MANUFACTURING CO.

MISSION MANUFACTURING CO. P. O. Box 4209, Houston, Texas Cable Address "MISSCO" Export Office: 30 Rockefeller Plaza, New York •
In the United Kingdom: MISSION MANUFACTURING CO., LTD., 1 Hanover Square, London W. 1 England • cable address "MISSOMAN"



MODEL 1F-50 Spec. 5



lightweight rig acts as portable oil field "handyman"

• OUTPUT CAPACITIES: 1-300 GPM • OPERATING PRESSURES TO 300 PSI

In oil field work, there is need for an all-purpose, low capacity, low pressure, high efficiency portable pump. An ideal unit of this type (assembled by Harley Sales Co., Tulsa, Okla.) is the combination of a Roper Model 1F-50 pump direct-connected to a Wisconsin power gear unit, mounted on structural steel skid. It handles 40 bbls. of crude oil per hour at maximum of 300 psi pressure. It's lightweight and well-balanced for transfer from one location to another in a regular field pickup truck. This rig also operates dependably and trouble-free in permanent installations. The Roper Series F pump is excellent for many oil field uses, in addition to pressure lubrication, general transfer, hydraulic power and fuel oil transfer.

Time-saving, low-upkeep features

- **FOUR-PORT DESIGN:** cuts installation time and cost . . . permits four clockwise, four counter-clockwise piping arrangements.
- **GEARS:** helical-type, heat-treated steel operating in axial hydraulic balance for quiet, vibration-free, long lasting service.
- **BACKPLATE:** design permits removal of internal parts without disturbing drive or piping.
- **SELF-LUBRICATION:** liquid pumped circulates through oil grooves in bearings and trunnions of pumping members for lubricating and cooling action.

For information about your specific pump needs contact your nearest Roper dealer

Send for "How to Solve Pumping Problems" booklet

ROPER HYDRAULICS, INC.

Dependable pumps since 1857

COMMERCE, GEORGIA

CPOG-R 10-12-27-21 Hussar, was drilled on LSD 10-12-27-21w4, to a total depth of 4,665 ft. (into the Mississippian horizon) and then plugged back to the discovery horizon for completion. Ten feet of the sixteen-ft. net pay sector was perforated and washed with 250 gal. of mud-acid. Initial flow rate, allowing the well to clean, was turned to tank and the 100-bbl. unit being used filled in 86 minutes. A rate of 60 bbl. per hour was calculated on the flush-flow.

Five-day production test was then begun and during the initial 24-hour period, through a ¼-in. choke the well was making 10 bbl. of crude per hour. As the conservation board also set a limit on the production test of 110 bbl. daily, the choke was cut back still further to 10/64 through which the well made 103 bbl. daily with tubing flowing pressure 640 psi. and casing pressure 1,080 psi. Gas-oil ratio meanwhile, measured 1 M.c.f. per bbl.

The strike is near a previously drilled Mississippian oil discovery well. That venture, however, has been shut in for some time due to its marginal qualities. The closest previous Glauconitic oil is 3½ miles to the south. That well, Liedke-Zapata 6-26-26-21 Hussar, is only a one-well pool to this date and will certainly never develop into one of any size as it is surrounded on three sides by gas wells which failed to yield further encouragement in the Glauconitic. In addition, Rosebud pool, which presently constitutes four Glauconitic oil wells is 5 miles to the northwest and Wayne Basal Quartz field is 4 miles east-northeast.

Wolfcamp is new pay for Admac area of Texas

The Wolfcamp Permian is a new pay for the Admac field area of Upton County, 4 miles east of Crane, West Texas. Discovery well is Gulf Oil Corp. 52-B J. T. McElroy, a triple completion in Wolfcamp, Bend, and Devonian.

From Wolfcamp perforations at 8,046-62 ft., the well flowed 430 bbl. of oil per day on ¼-in. choke. From perforations at 8,836-88 ft. it flowed 292 bbl. per day on 20/64-in. choke. From Devonian at 9,984-10,443 ft. the well flowed 88 bbl. of oil per day. Loca-

tion is in Section 187, Block F, CCSD&RGNG Survey.

Midland County. Texaco Inc. completed 1 B. F. McKandles in western Midland County, 9 miles southwest of the city, flowing 502 bbl. of oil per day from Ellenburger Cambro-Ordovician. Perforations at 13,092-13,107 ft. were reported. The well also flowed 13 bbl. of oil per hour from Fusselman Silurian at 12,564-84 ft. Location is in Section 30, Block 40, T-2-S, T&P Survey. Location is 4 miles east of Headlee Ellenburger production.

Southeast Crane County adds Glorieta production

A flowing Glorieta discovery is reported in southeastern Crane County, West Texas. The strike is Bayview Oil Corp. 1 Eppenauer, 11 miles south of Crane.

The well flowed 227 bbl. of 42.8°-gravity oil daily through 20/64-in. choke. Production is from perforations at 3,012-30 ft. Location is in Section 10, Block 6, H&TC Survey, 1 mile northwest of Eppenauer field.

Midland. Texaco Inc. 1 B. F. McKandles, apparent Ellenburger discovery in western Midland County, 9 miles southwest of the City of Midland, flowed 20 bbl. per hour through perforations at 13,094-13,108 ft. Potential is being taken. Location is in Section 30, Block 40, T-2-S, T&P Survey, ½ mile southeast of Strawn production, ½ mile southwest of Devonian production, and ½ mile northwest of Spraberry production in Warfield field. Nearest Ellenburger oil is 4 miles west in Headlee field.

Two gas discoveries reported in Zoller, Texas

Two wildcats were reported as gas strikes in southwestern Calhoun County, Southwest Texas. Lamar Hunt 1 State Tract 79, east of Zoller field production, located in San Antonio Bay, 8 miles southeast of Austwell, flowed 36,500 M.c.f.d. from Frio G at 9,007-34 ft. This well opens East Zoller Frio G field.

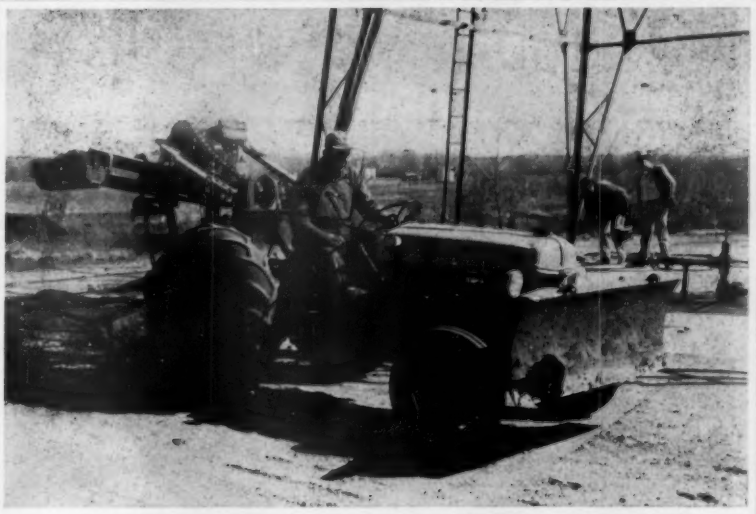
The 1 State Tract 96, opener of East Zoller Frio F field, flowed 1,510 M.c.f.d. from perforations at 8,828-34 ft. Gas is rich in condensate.

Live Oak County. Tenneco Oil Co. will drill a 15,500-ft. Edwards lime wildcat in north-central Live Oak County. The 1 Alamo Lumber Co. is 7 miles north of Three Rivers, between Isaacs Edwards field and Shell 1 O'Neal, currently testing Edwards discovery in Bee. Isaacs is the only Edwards field in Live Oak, while the Shell well is the first for Bee. Location is in Lot 80, Live-Bee Land Subdivision, 3,000 ft. north and 2,000 ft. west from southwest corner of W. Gant Survey, N. Navarro Survey, A-507.

Morrow gas discovery finaled in Panhandle

Morrow Pennsylvanian gas production is reported at a Shell Oil Co. wildcat in Hemphill County, Texas Panhandle. The 1-68 Fred Hobart Ranch, 12 miles south of Canadian, flowed 6,500 M.c.f.d. from upper Morrow perforations at 13,154-81 ft. This is one of the deepest Morrow producers in the Anadarko basin.

Location is in Section 68, Block A-2, H&GN Survey. Nearest Morrow production is 12 miles east in



HOW 116 OIL WELLS WERE PROTECTED FROM CORROSION

Several leaks, caused by external casing corrosion, had already occurred in this Permian Basin field of 116 wells. No previous attempt had been made to stop the corrosion.

To determine the current required for protection, CSI spot checked 25 of the wells—using the "log current potential method" developed and patented by a CSI engineer.

It was found that a maximum of 6 amperes was sufficient to stop corrosion. However, it was decided to use 8-ampere rectifiers as the current source so that there would be a reserve to meet changing requirements caused by weather. In some instances it was found advisable to install 16- and 24-ampere rectifiers to protect 2 or 3 wells in groups.

CSI's experienced crews handled the complete installation, furnishing the rectifiers, all other necessary materials and equipment, plus a full report.

You will find CSI an economical, reliable source for engineering and installation services; and for cathodic protection supplies including Dow magnesium anodes.

CSI

Cleveland 13, Ohio
1309 Washington Ave.
Tel. CHerry 1-7795

CORROSION SERVICES INCORPORATED
General Office, Tulsa, Okla.
Mailing Address:
Box 787, Sand Srings, Okla.
Tel. Circle 5-1351

the 13,250-ft. Pennsylvanian at Washita Creek Penn field. Nearest production other than Pennsylvanian is 12 miles northwest at Red Deer Wolfcamp field. Shell will call the new field Alexander Upper Morrow.

Ochiltree County. Shamrock Oil & Gas Corp. 1 A. L. Buzzard, 23 miles west of Perryton, Hansford field, flowed 97 M.M.c.f.d. from lower Morrow perforations at 7,890-7,915 ft. Location is 1¾ miles southwest of Daniel's Morrow field in Section 23, Block R, B&B Survey.

Texas adds gas-condensate finds

IN TEXAS, Delhi-Taylor Oil Corp. announced the completion of two gas-condensate discovery wells jointly with Shell Oil Co. on the San Ramon grant in Hidalgo County.

The first well, 1 Woods-Christian, was completed in the Vicksburg sand (Oligocene age) producing from perforations at 10,586-10-610 ft. and 10,617-40 ft. The well was tested at 12,700 M.c.f.d. with 31 bbl. of condensate per M.M.c.f.d. of gas, on an open-flow potential test, with 69 ft. of net effective productive sand. The well was drilled to a total depth of 13,-322 ft.

The second well, 2 Woods-Christian, also was completed in the Vicksburg sand, producing from perforations in the interval from 11,086-11,104 ft. This well tested at 145 M.M.c.f.d. with 27 bbl. of condensate per M.M.c.f. of gas. There were 149 ft. of net effective productive zones in the well which was drilled to a total depth of 11,505 ft.

Before completion of Woods-Christian 2, Shell Oil Co. had earned 50% of Delhi's working interest in 12,000 acres in the area by completing prior drilling commitments. Plans are being made to drill two or three more wells to further develop this field this year.

Texas' Limestone County adds Woodbine well

Woodbine production is reported at a wildcat in northeastern Limestone County, East Texas. The discovery well is R. R. Cocke-Gibson Drilling Co. 1 Margaret Hayter, Robert Toller Survey.

The well pumped 32 bbl. of 42.7°-gravity oil and 80% salt water per day from perforations at 3,802-6 ft. Location is 3 miles west of Wortham and 2 miles west of Woodbine production in Wortham field.

East Shiloh. Gibson Drilling Co. and Cochran & Bradshaw completed 2 Joe Densmore as a Blossom oil discovery for East Shiloh field, southwestern Panola County, East Texas.

The well flowed 82 bbl. of 46.8°-gravity oil per day through 10/64-in. choke. Perforations are at 3,018-27 ft. Location is in the Henry G. Hudson Survey, 3½ miles southwest of Dotson, south of the Rodessa gasser which opened East Shiloh field recently.

That well was the 1 Joe Densmore on the Henry G. Hudson Survey. Flow was 6,800 M.c.f.d. plus 16 bbl. condensate per million from upper Rodessa perforations at 6,270-82 ft. Nearest Blossom sand

Target ECONOMY • SERVICE • SAFETY

There's no danger of over-buying when you specify W. C. Norris Well Head Equipment, for the Norris line is a complete line . . . with a wide range of tubing and casing heads engineered to meet your actual needs. Norris heads offer you high selectivity . . . true economy . . . without sacrificing design, service or safety. You can buy with confidence when you buy Norris. Write for prices and complete literature today!

BUY FROM YOUR NORRIS DISTRIBUTOR

W. C. NORRIS DIVISION
DOVER CORPORATION
P. O. BOX 1739 • TULSA, OKLA.

NORRIS HINDERLITER
WELL HEAD EQUIPMENT

BRANCHES: Great Bend, Houston, Kilgore, Odessa, Wichita Falls, Salem, Casper, Farmington

production was at Tacoma on the northeast edge of big Carthage field, 27 miles northeast of the new well.

Leon County. J. W. McFarland and Gibson Drilling Co. completed a new oil discovery near Leona in southern Leon County, East Texas. The well, 1 F. L. Thompson, flowed 249 bbl. of 36.2°-gravity oil per day on ¼-in. choke. Production is from perforations at 7,134-40 ft. in the sub-Clarksville. Location is in the Alse Garrett Survey, A-7, 1½ miles southeast of Leona.

Dual gas find listed in Espiritu Santo Bay, Texas

A new dual gas discovery for South Texas' Calhoun County is Sun Oil Co. 192-1 Espiritu Santo-State. The lower zone flowed 15,300 M.c.f.d. at 6,162-88 ft.; the upper zone at 1,858-66 ft. made 10 M.M.c.f.d. Location is in State Tract 192, Espiritu Santo Bay, 22 miles southeast of Port Lavaca and 4 miles northeast of Steamboat Pass field and 6 miles southwest of Farwell Island field.

Deep Wilcox. Cosden Petroleum Corp. 1 S. E. Crews III, Goliad County wildcat, flowed gas on drill-stem test at 10,360-66 ft. This Wilcox prospect is 5 miles northwest of the town of Goliad in Maria Jesusa de Leon Grant, A-22, 6 miles north of Riverdale Wilcox field production.

Offshore. Shell Oil Co. will drill a 13,000-ft. wildcat off Galveston County in the Gulf of Mexico. The well will be drilled 28 miles southeast of High Island town on a 5,760-acre block, Federal Block 160, OCS-0743, Federal High Island area, Gulf of Mexico. Closest production is 15 miles north at Standard of Texas 1 Federal Block 52, an unnamed oil area.

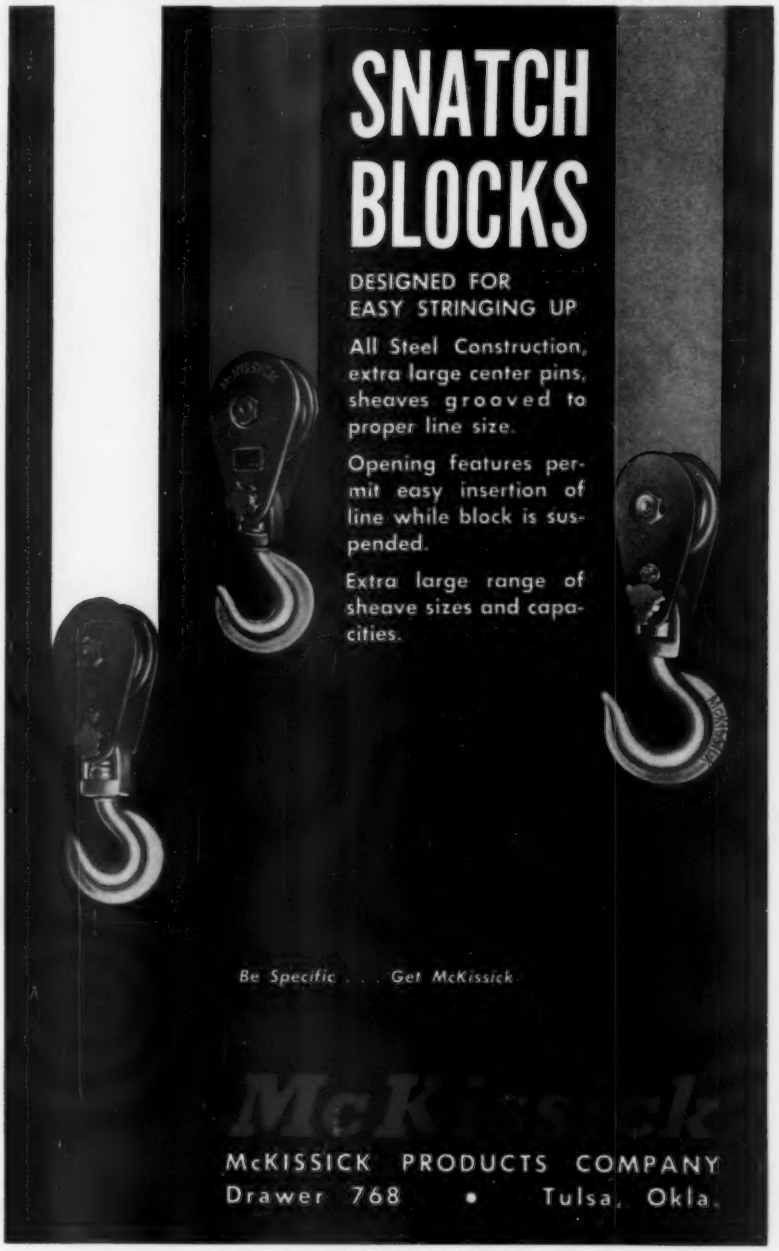
Big gasser reported in Hidalgo County, Texas

A South Texas wildcat discovery flowed 145 M.M.c.f.d. It is Shell Oil Co. 2 Woods Christian, Vicksburg Q sand pay discovery in the undeveloped McAllen Ranch field of northwestern Hidalgo County, 5 miles southeast of La Reforma. This is Shell's third well, but only the second on which tests have been final.

Production is from 11,086-11,104 ft. Condensate ratio was 40,100:1. Location is in San Ramon Grant. It lies 2,900 ft. southwest of the No. 1 well which opened production in the Vicksburg P sand at 10,586-10,640 ft. last year. That well made 12,700 M.c.f.d. and condensate at the rate of 30 bbl. to the million. The 1 A. A. McAllen is shut in pending a workover project.

Karnes County. Texas Eastern Transmission Corp. 1 Ethleen Hubble, Edwards lime gas discovery in Karnes County, 6 miles east of Runge, flowed 14 M.M.c.f.d. from perforations at 13,805-13,908 ft. This big well is the J. T. Price Survey, A-234. It is the second deep Edwards well for the company here. The first was drilled in DeWitt County to the northeast. That well, 1 Garbe, opened KaWitt Edwards lime field.

Jefferson County. Nicco Oil Operations Inc. 1 E. D. Causey, southwestern part of Cook's Lake field,


SNATCH BLOCKS
DESIGNED FOR EASY STRINGING UP
All Steel Construction, extra large center pins, sheaves grooved to proper line size.
Opening features permit easy insertion of line while block is suspended.
Extra large range of sheave sizes and capacities.
Be Specific . . . Get McKissick
McKISSICK PRODUCTS COMPANY
Drawer 768 • Tulsa, Okla.

NEW

SYNTHETIC RUBBER SUCKER ROD GUIDES

are saving producers thousands of dollars in workover fees and equipment replacement costs.

These patented Snap-On Guides are fully described in Bulletin No. 8160.

Get size, price and installation data free of charge.

WRITE FOR

BULLETIN NO. 8160

"OIL FIELD RUBBER PRODUCTS OF MATCHLESS QUALITY"

Oil States

OIL STATES RUBBER CO.

DRAWER 152
ARLINGTON, TEXAS

OSR-21

flowed 13 M.M.c.f.d. and condensate from 7,350-ft. Frio sand perforations at 7,279-85 ft. Gas-liquid ratio is 125,000:1. Location is 5 miles north of Beaumont in the Thomas Spear Survey, A-50, Block 8. Nearest production is 1,500 ft. northeast at Meredith 1 Cruse, a dual gas and gas-condensate producer.

Utah field extended

In Utah, Sunray Mid-Continent Oil Co. has extended Red Wash field of Uintah County with the completion of the 1 Utah Federal "D," C SW SW 14-7s-24e, located on a wholly owned 2,240-acre lease.

Nearest production is 1½ miles to the northwest. Tests on the well flowed 6,262 M.c.f.d. through ½-in. choke from the lower Green River formation at perforated intervals from 4,987-5,025 ft. Tubing pressure registered 1,000 lb. The hole was drilled to 5,410 ft. with 5½-in. casing cemented on bottom. The well is 20 miles southeast of Vernal, Utah.

Two gas finds for Wyoming

Two gas discoveries highlight Wyoming exploratory news this week. One is northwest of West Desert Springs field in Sweetwater County; the other is in Fremont County at Frenchie Draw.

The Sweetwater discovery is Chandler & Simpson 1 Winegardner-Government, SW NE 12-20n-100w. It flowed 7,500 M.c.f.d. during tests in the Almond Cretaceous sand at 2,890-2,905 ft. Location is 2½ miles northwest of West Desert Springs field, an Almond sand producer.

The Frenchie Draw discovery is Humble Oil & Refining Co.'s 1 Unit, C NE NE 21-37n-89w. It made more than 5 M.M.c.f.d. on drill-stem test at 9,100-88 ft. This was the thirteenth test run at the discovery, all of them successful.

Kentucky well drilling ahead

In Lewis County, eastern Kentucky, United Fuel Gas Co. is drilling below 4,200 ft. at its wildcat 1 Alice Shephard. Test is located in 19-W-75, 2,050 ft. from east line and 1,050 ft. from north line. This is one of two sub-Trenton exploratory ventures in the eastern half of the state.

made for play...

loves to work!

75 hp Starflite III by Evinrude—new 1961 version of boating's best-selling, big-powered outboard motor. New fixed-jet carburetion is combined with thermostat controlled engine temperature for peak efficiency under all conditions. Every advanced feature: Famous Jetstream Drive, electric starting, automatic choke, sea-going magneto ignition, two-way shock absorbers, quietest performance on the water. Smooth running V-4 engine with 89 cu. in. displacement attains full hp at leisurely 4500 rpm. High-torque, versatile power for a wide range of waterfront duties and commercial boating jobs. See your Evinrude dealer—listed in the Yellow Pages under "Outboard Motors."

Evinrude Motors, 4143 N. 27th Street, Milwaukee 16, Wis.
A Division of Outboard Marine Corporation
In Canada: Mfd. by Evinrude Motors, Peterborough

EVINRUDE
FIRST IN OUTBOARDS

You PROFIT with Sound Financing

Riverside 1-4181

Oil and Gas Dept.
MERCANTILE National Bank at Dallas

BETTER HYDRAULICS are built into REED FLUSH-FLO JET BITS

up to 50% more return area

REED and ONLY REED offers you jet bits with FLUSH-FLO action and these six exclusive features.

1. Additional return circulation area for faster removal of cuttings.
2. Self cleaning action in the bit head as well as over the teeth.
3. Reduced bottom hole pressure that makes jets more effective.
4. Minimized hydrostatic pressure on formation when running bit in hole.
5. Minimized swabbing action when pulling bit.
6. Less hole enlargement in softer formations.

These six Reed exclusive advantages mean *dollars saved* for you. Let the Reed man who calls on you give you the full story. He can show you how Reed Y Bits actually give you more footage per dollar spent.

REED

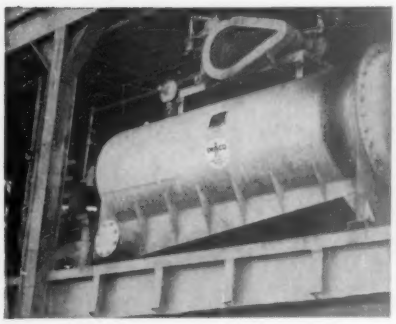
REED ROLLER BIT COMPANY

Houston 1, Texas

Export Office: Time and Life Bldg., Suite 3744 Rockefeller Center, New York 20, N.Y.—Reed Roller Bit Company (Nederland) N. V., Rooseveltstraat 6, Leiden—Reed Roller Bit Company, Ltd., 4431 6th St. S.E., Calgary, Alberta.

Three good ways to cut drilling costs

The three units shown here are important items behind the recent revolution in drilling fluids that has done so much to speed drilling and cut costs. Each is designed for a different problem but all are efficient and economical. Equally important, all are handled by SWACO -- the leader in mud-treating equipment.



SWACO D-GASSER®

Operators frequently report saving the entire rental cost of a D-Gasser on a well in less than a day.
When mud is gas-cut, the D-Gasser saves money in many ways. It cuts time lost for circulating after trips. It reduces barite costs, it minimizes lost circulation costs and problems. It maintains mud pump efficiency and it actually makes possible the close control of mud weight and viscosity that results in faster drilling with increased safety.

CLAYJECTOR®

If you are using mud as heavy as 12 pounds per gallon, you can cut mud costs and increase drilling rate by using a Clayjector. This is a cyclone-type separation unit that is extremely effective at rejecting unwanted clays and retaining expensive barite.
In addition, since it makes possible the economical maintenance of a low-solids, low-viscosity mud, it actually permits a reduction in bit costs and drilling time.

D-SANDER®

The D-Sander greatly increases the life of mud pump parts and bits when sand or abrasive shale is being drilled. Since it removes virtually all sand-sized solids from the mud, excessive pump-parts and bit-nozzle wear — as well as many other problems — are avoided when a D-Sander is used. There is a size and type to fit every rig and drilling condition.

These descriptions tell just a few of the many ways you can cut costs by mechanical mud treating. For the full story on how you can profit, call your nearest SWACO representative or write us direct.

SWACO

SALT WATER CONTROL, INC.
707 FORT WORTH NATIONAL BANK BLDG., FORT WORTH 2, TEXAS
Telephone: EDison 2-4433 Cable Address: "SWACO" Fort Worth

LOUISIANA: New Orleans, Lafayette
OKLAHOMA: Oklahoma City
TEXAS: Houston, Corpus Christi, Fort Worth, Kermit
COLORADO: Durango

Discovery wells

SOUTH TEXAS

Live Oak County, Braslau area:
Peet Oil Co. 1 Prosen et al. unit, 3 miles southwest of George West in L. A. Fant Sur., A-602. Lot 209, Blk. "A," George West Ranch Subd. IPAOF 13 M.M.c.f.d., 51.3°, GLR 61,200:1, Slick Wilcox 7,889-90 ft. TD 8,313 ft. New gas discovery.

WESTERN CANADA

Alberta:
CPOG 10-25 Nacmine, LSD 10, 25-28-21w4. TD 4,730 ft. Gas discovery.
Canpet-LM-CPOG 7-8 Redland, LSD 10, 25-27-22w4. TD 5,160 ft. Glouconitic gas discovery.

British Columbia:
Dome-Prove C-46-H Laprise Creek, 46-H-94-G-8. Triassic gas discovery. TD 4,519 ft.

Saskatchewan:
Kissinger-Canso-Climax 9-27 West Carievale, LSD 9, 27-1-32w1. Frobisher oil discovery. TD 4,054 ft.

KANSAS

Barber County:
Woodman-Iannitti 1 Zimmerman, 5 miles northwest of Kiowa in C SE SE 12-34-12. IPF 5,200 M.c.f.d., Miss. 4,462-80 ft. TD 4,730 ft. New gas discovery.

Barton County:
Leo J. Dreiling 1 Welch, 2½ Miles southeast of Great Bend in SW NW NE 32-20s-13w. IPP 35 BOPD, Arbuckle 3,454-58 ft. TD 3,510 ft. New oil discovery.

Harper County:
Cities Service Petroleum Co. 1 Mattingly, 6 miles southeast of Anthony in SW NW NE 12-34s-6w. IPP 32 BOPD, Kansas City 3,761-69 ft. TD 5,158 ft. New oil discovery.

Kingman County:
Thunderbird Drilling Co. et al. 1 Klaver, 4 miles northwest of Orsemus pool in C SE SW 9-29s-6w. IPF 25 BOPD and 1,040 M.c.f.d., Miss. 4,112½ and 4,119½ ft. TD 4,170 ft. New oil and gas discovery.

Ness County:
Birmingham-Bartlett Drilling Co. 1 Geiss "B," C SW NW 10-16s-25w. 8 miles northwest of Ransom. IPP 201 BOPD, 5% water, 38°, Miss. open hole 4,504-10 ft. TD 4,510 ft. New oil discovery.

Russell County:
Fred J. Haymes 1 Elsasser, SE NE NW 23-12s-15w. 6½ Miles northwest of Russell. IPP 42 BOPD, 50% water, 39°, Lansing-Kansas City 2,882-3,012 ft. TD 3,161 ft. New oil discovery.

Stevens County:
Mobil Oil Co. 1 Cutter, 3 miles southeast of Hickfield, 15 miles northeast of Hugoton in C SW SE 1-31s-35w. IPF 71 BOPD, no water, 48°, Morrow 5,312-15 ft.; IPF 1,448 M.c.f.d., Chester 5,584-5,600 ft. TD 6,978 ft. PBTD 5,630 ft. Dual oil and gas discovery.

NORTH LOUISIANA

Caddo Parish:
The California Co. 1 Floyd E. Volentine et al., 33-20n-14w. IPF 29 BCPD plus 957 M.c.f.d., 28/64-in. choke, 66.3°, TP 260 psi., Cotton Valley 7,216-24 ft. TD 8,704 ft. New gas-condensate discovery.

Union Parish:
Southwest Gas Producing Co. 1 J. J. Hamilton unit, 30-19n-1e. IPF 4,149 M.c.f.d., 168 BCPD, 10/64-in. choke, TP 3,180 psi., GCR 24,680:1, 79.1°, Vaughn sand, Cotton Valley 9,024-39 ft. TD 9,395 ft. New gas-condensate discovery.

SOUTH LOUISIANA

Iberville Parish:
F. A. Callery 1 L. N. Folse, 17-10s-13e. IPF 100 BOPD plus 4 M.M.c.f.d., 14/64-in. choke, 10,722-26 ft. TP 3,250 psi., GLR 40,000:1. TD 11,270 ft. New gas-condensate discovery.

MICHIGAN

Oceana County:
W. L. Harvey 1 Skidmore, SW SE NE 15-16n-16w, Crystal Township, AIP 800 M.c.f., A-2 Salina, 4,094; TD 5,985. New pay in Crystal Valley pool.

St. Clair County, Adair:
E. Edwin Brehm 1 Dziedzic, SE SE NW 12-4n-15e, AIP 129 BOPD. Brown Niagara reef 2,719; TD 2,722. New oil pool.

Wayne County:
Peake Petroleum Co. 1 Zittel, SW SW NE 25-1s-8e. AIP 400 M.c.f. A-1 Salina 2,166, Trenton 3,655; TD 4,374. Extension Northville field.

NEBRASKA

Furnas County:
Exeter Drilling Co. 1 Palmer, C NE SE 17-2n-25w. IPP 131 BOPD, cut 2% b.s. and w. Reagan 3,391-94 ft. TD 3,445 ft. Reagan discovery, new field.

Kimball County:
Chandler & Simpson 1 Kennedy-Johnson, C SW NW 2-13n-58w. IPP 150 BOPD, "J" sand 7,250 ft. TD 7,302 ft. "J" sand discovery, new field.

NEW MEXICO

Lea County:
Carper Drilling Co. 1 Blakey, 4½ miles northeast of Monument in 29-19s-38e. IPP 30 BOPD plus 29 BWPD, 4,282-88 ft. New oil discovery.

OHIO

Athens County:
A. Real 15 Lenora R. Williams, Fr. 17, Rome Twp., Clinton 4,577-94 ft. TD 4,749 ft. Medina 4,735-47 ft. IP 30 BOPD from Medina. New oil pool. IP 42 M.c.f.d.

Gallia County:
H.H.&R. Operator Acc't. 1 John W. Gills, Sec. 28, Perry Twp. IP 3,090 M.c.f.d., Clinton 3,414-39 ft. TD 3,447 ft. New gas field.

Portage County:
Atlas Exploration Corp.-Sun Oil Co. 1 Franks, Lot 16, Atwater Township. IP 5 BOPD and 130 M.c.f.d., Clinton 4,794-4,876 ft. TD 4,890 ft. New oil and gas discovery.

OKLAHOMA

Custer County:
Mobil Oil Co. 1 Mattie E. Horton North Thomas unit, C SE NW 14-15n-15w, 8½ miles east of North Custer City field. IPF 188 BOPD, Oswego, 10/64-in. choke, 9,722-78 ft., FTP 670 psi., GOR 4,255:1, 42°; IPF 1,017 M.c.f.d. with 8 BCPD, 24 hours, from Meramec 13,192 13,360 ft. TD 14,869 ft. PBTD 13,745 ft. New oil discovery, dual completion.

UTAH

Uintah County, Stage Coach unit:
Belco Petroleum 1 Unit, NW SE 32-8s-22e. IPF 645 M.c.f.d., shut in. Wasatch discovery, new field. TD 7,907 ft.

WYOMING

Sublette County, Long Island unit:
Belco Petroleum Corp. 2 Liu, NW NE 35-29n-112w. IPP 28 BO, 4 BWPD, Wasatch Tertiary 4,258-83 ft. TD 4,393 ft. Wasatch discovery, new field.

J. K. LASSER Tax Institute Shows Extraordinary Returns from OIL & GAS

USE THIS MANUAL FOR 2 WEEKS WITHOUT COST!

NEW YORK, N. Y. —A costly research project into the fabulous field of oil and gas investments has just been completed by the J. K. Lasser Tax Institute. Their findings are of urgent importance now to individuals who seek extraordinary capital growth and high income from relatively small investments—*in addition to tax advantages of a truly unique nature.*

Until now there has been no single source of accurate and unbiased information on this enormously rich area of investment. That is why investors should not fail to see a free examination copy of this extraordinary new guide.

How To Get Tax-Protected Income From Oil and Gas Investments

Revised & Enlarged 2nd Edition

Now you need not be an "insider" to participate in the tremendous income, capital building and tax benefits inherent in oil and gas. This manual shows you:

(1) How to get into oil and gas investments; how investment opportunities develop and how to share in them; acquiring interests; joint operations; development, operation, and payments in investors, etc.

(2) How taxes reduce the risk; tax plans which produce maximum net-after-tax returns; family tax plans; organizing oil and gas ventures; assuring your retirement through oil.

(3) Actual case-histories of oil and gas investments and the potential payoffs (with these to guide you, you can readily decide the best money-making strategy.)

Why miss out on the benefits of this tremendous field? Send today for a free examination copy. Keep it for two weeks, then return it without obligation, or keep it and send only $12.50 plus shipping charges in full payment. (Save shipping charges by remitting $12.50 now—same refund privilege.) Write today to Dept. OG-19, Business Reports, Inc., Larchmont, New York.

ET-8722

VERSATILE!

Here is an ideal vehicle for the rough jobs, out where the roads don't exist. Where the mud, the sand, the ruts can make life impossible for a conventional two-wheel-drive truck of any size. This is the Dodge model W100, one of five rugged Dodge 4 x 4 models that range in capacity from 6,000 lbs. to 20,000 lbs. GVW.

The W100 is powered by a 140 hp. inclined engine, the Dart Power Six. Optional power can be provided by a 200 hp. truck V8. Standard transmission is 3-speed synchromesh, with a 4-speed synchromesh box an optional extra. A 2-speed, 2-lever transfer case with either transmission directs power to the rear axle or to both axles at the driver's option. The model shown here is the Sweptline pickup. Additional body styles on the W100 chassis include a conventional pickup, a panel, and the versatile Town Wagon model, all handy workers on or off the road.

Larger Dodge 4 x 4 models include the W200, W300, W500, and the WM300, the last a familiar vehicle to anyone who served in the armed forces. Except for the WM300, all models are available with optional Six and V8 power, and standard hydraulically-actuated clutch. The WM300's engine is a rugged, dependable 125 hp., 251 cu. in. Six.

Talk trucks with your dependable Dodge Dealer. He'll tell you some interesting things about 1961 Dodge trucks. One is that, model for model, they are priced competitively with any other truck you can name. Another is that Dodge trucks are backed by a new 24-hour-a-day, seven-days-a-week emergency parts operation. Wherever you and your Dodge truck may be, you can be sure of rapid delivery of the parts you need to keep you on the job. SEE YOUR DODGE DEALER.

1961 DODGE TOWN WAGON on the W100 chassis. Available in six and eight passenger capacities. Supplied on a 114" wheelbase. Powered by new Dart Slant Six 140 hp. inclined engine or 200 hp. V8 engine. With two rear seats removed, 155 cubic feet of cargo space available. Ideal for dependable, economical operation, on and off the road, on all surfaces.

DODGE BUILDS TOUGH TRUCKS

A PRODUCT OF CHRYSLER CORPORATION

Cut transfer costs—
keep records straight

Metered ACT and LACT systems are in your best interests. They provide printed records for proof of conservation control. They lower your operating costs. They verify all quantities transferred. And metered systems provide reliable records for billing purposes as well as firm facts upon which to base royalty and tax obligations.

Rockwell meter systems combine *all* the components you need for protection and savings on your lease. Rockwell meters have an all-revolving measuring mechanism which turns freely on anti-friction bearings without metal-to-metal contact. Rockwell air eliminators insure accurate measurement of liquid volume by removing all entrapped vapors. Automatic temperature compensators translate metered measurement to a uniform base temperature. Ticket printing registers simplify your accounting. Electric impulse contactors actuate remote counters and/or control solenoid valves or pumps for automatic shut-off.

Rockwell meter systems have a proven record of success in oil fields throughout the world. For full facts write: Rockwell Manufacturing Company, Dept. 132E, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

OIL FIELD METER SYSTEMS

another fine product by

ROCKWELL

Veteran Gets Top TIPRO Spot

• Energetic leadership can be expected from James West, who's already served association in many capacities.

MEMBERS of TIPRO—long some of the country's most stubborn, dedicated battlers against foreign oil imports—can count on this fight being waged energetically in the coming year.

Their new president, James F. West of Stamford, Tex., regards the imports problem as the foremost of the many he will face during his term of office.

"I say this with all due respect to import-program administrators who still contend that it is really not oil imports that are hurting the Texas oil producer," he declares.

But it is a matter of record, he says, that imports of foreign oil are steadily increasing while Texas production has actually declined.

The stocky, serious West Texan was elected TIPRO's thirteenth president during the association's annual meeting in Midland.

West is primarily a producer but does some drilling contracting and is part-interest owner in several gas-processing plants. He is a partner in Turner & West and West & Honea, both based in Stamford.

Bulk of his production is in West Central Texas, with other holdings in Oklahoma and New Mexico.

James F. West
. . . imports problem comes first.

Oil veteran . . . A second generation oil man, West was born in 1904 in Warren, Ind., where his father, James H. (Kid) West, had followed an oil play.

The younger West left San Diego (Calif.) State University for the oil fields in 1922 during the heighth of the Eastland, Ranger, and Breckenridge booms in Texas. Starting at Cisco, Tex., he worked closely with his father until the elder West died in 1941.

From Cisco, West moved successively to Olney, Graham, Gladewater, back to Graham, to Big Spring, and ended up at Stamford in 1937. His long association with R. C. Turner began in 1924.

Broke in early . . . Serving as TIPRO's top executive will not be entirely new to West.

He presided over several important committee meetings as acting president last year during a short period when outgoing president, John Hurd, was out of the country.

He has served TIPRO in just about every possible position.

Last year, he was association secretary. He has been a director several times, a member of the important executive committee twice, and has worked actively on both the imports and legislative committees.

West has also been an active worker for the West Central Texas Oil & Gas Association and is a member of the Independent Petroleum Association of America and the Texas Mid-Continent Oil & Gas Association.

TIPRO, however, remains his main interest. "I have always felt," he said, "that of all the many oil associations TIPRO most truly represents the best interests of the independent oil operator."

▶▶▶ Personals

W. Stewart Boyle, president of Texas National Petroleum Co., Houston, was elected new TIPRO secretary at annual convention in Midland, Tex., last week. He replaces **James F. West,** who moves up to president (see above).

C. S. (Andy) Stiteler, district geologist in Casper, Wyo., for Skelly Oil Co., has been transferred to the company's headquarters office in Tulsa as a division geologist. **Robert M. Wakefield,** staff geologist in Casper, has succeeded Stiteler there. In other changes, **Warren O. Oates,** geologist in Denver, has been transferred to Wichita, and **Don A. Berg,** geologist, has been transferred from Denver to Casper. **Dean A. Rowe,** formerly with Kewanee Oil Co. in Columbus, Ohio, has joined Skelly as geologist in Columbus.

Dwayne H. Anderson, geologist with Kewanee Oil Co., has been transferred to Denver from Wichita.

Walter Kuhn, Walter Kuhn Drilling Co., Wichita, has been reelected president of Kansas Independent Oil and Gas Association. **J. A. Mull, Jr.,** was elected vice president at the group's annual meeting last week. Other officers are **E. B. Shawver,** life-time vice president; **John Knightley,** secretary; and **Jack Spines, Jr.,** treasurer. Area vice presidents are **H. A. Palmer,** Medicine Lodge; **John O. Farmer,** Russell; **V. W. McKnab,** Winfield; **J. E. Morris,** El Dorado; and **Herbert A. Harms,** Great Bend.

F. A. Thurman will join Forest Oil Corp. June 1 as northwest division geologist with headquarters in Denver.

N. F. Chamberlain has been promoted to research specialist in the research and development division of Humble's Baytown, Tex., refinery.

I. C. Anderson, vice president and general sales manager of Creole Petroleum Corp., has been named vice president of Esso Export Corp. and general sales manager in the cargo-sales department. The appointment is effective June 1. Anderson will succeed **Don Swan,** recently named senior Eastern Hemisphere adviser for Esso Export in London.

(Personals continued on Page 138)

Report for 1960

The British Petroleum Company

Extracts from annual statement to stockholders by the

HON. MAURICE BRIDGEMAN, *Chairman*

World demand for oil outside the Communist bloc in 1960 rose by about 1,260,000 barrels a day or 7.5%. In the US demand rose by only 260,000 b/d or 3%, whereas in Western Europe the increase was 580,000 b/d or 17%. This rising demand has been accompanied by greatly increased competitive activity, due primarily to a "surplus" of oil. There has in fact been a potential surplus of production for many years. What has occurred recently is that those who have developed new sources of oil, anxious to recover their investment, have stimulated production to a rate higher than the market can readily absorb and in so doing compete for outlets held by established producers. It is this, coinciding with the restriction of crude oil imports into the US, and an increase from 340,000 b/d to 450,000 b/d in 1960 of Soviet zone oil sold in the free world at low prices, which has created a "surplus" position.

It is often asserted that seven or eight large companies are able to dominate the international oil business and form a club to which no further members can be elected. This is very far from the truth. The larger companies compete very actively with each other as well as with the so-called independents, and have achieved their positions slowly and laboriously, by keeping in the forefront of technical development, by charging reasonable prices to consumers, and by paying a fair rent to the landlord, rather than by taking advantage of short-term opportunities.

The statement that a fair rent is paid to the landlord is often challenged, for there is still a widespread belief that, in spite of the "50/50" agreements for sharing the profit arising from the production operation, the oil companies are depriving the producing countries of a fair share of the profits. I would like by reference to our results, to place this suggestion in a more accurate perspective.

Payments to the Middle Eastern countries under the "50/50" agreements are based on posted crude oil prices, and the total sum included in our 1960 accounts for such payments was $358,400,000. This figure is substantially greater than that for 1959, despite the slight reduction last August in Middle East posted prices.

BP Group profits, which represent the net result of all the operations involved, and not merely those related to production, last year amounted to just over $174,000,000.

It is not possible for us to bring to the consumer the ever greater quantities of oil which are required unless we provide not only the production facilities, but also the necessary tankers, pipelines, refineries, and marketing installations. But although the increase in revenues of the producing countries depends on the availability of all these facilities on a steadily mounting scale, the Governments concerned are not obliged to spend on the provision of such facilities any of the money they receive from oil royalties

THE BRITISH PETROLEUM COMPANY

and taxes, and they are, therefore, free to direct their revenues towards those projects which are vital to their economic development.

Furthermore, to the capital required for the development of market outlets must be added the capital needed to search for additional sources of supply, for it would not be prudent to cease exploration while market requirements are increasing. Capital expenditures of the BP Group for the period 1958-1960 totaled $1,092,000,000. With the additional need for increased working capital, the money BP has had to find over the period was not less than $1,176,000,000. As a result, there has been a large gap between the amount we have had to find for capital expenditure and the amount we have been able to accumulate out of each year's operations. The only way to bridge this gap is to borrow from the world's capital markets. Our Group is in no way unique in having to find some of the money required for capital expenditure by borrowing from third parties.

The oil industry's part of the "50/50" bargain thus involves not only the acceptance of the risks—which are very considerable—but also the responsibility for providing all the capital for the refining, transport and marketing, as well as for the actual production of the oil. I do not think this can reasonably be described as a bad bargain for the people of the producing countries.

The extent to which the industry must rely on the capital markets for further expansion makes it essential that we should try to maintain reasonable and reasonably stable price levels. For if prices fall, the proportion of the sum the industry must obtain from the money markets will increase. It is consequently a cause for concern that, in attempting to maintain these price levels, companies such as ours, which operate on commercial principles, should have to meet severe competition from those which can rely on preferential positions and financial support from their governments. Such competition has now to be faced not only from behind the Iron Curtain, but also from other directions.

The maintenance of a reasonable stability of prices is rendered more difficult by another current tendency. In a period of over-supply it is not difficult for independent operators to buy relatively small quantities of oil products at very favorable rates and sell them cheaper than the established companies in limited areas which are easy to supply. These operators are able to take advantage of short-term considerations, including abnormally low freight rates. They are not concerned with longer term responsibilities to maintain supplies throughout the world, often in difficult markets. They do not have to carry the expenses of prospecting, transportation, refining and research; nor need they include in their prices any element to provide the facilities necessary to meet a growing demand.

As to the future, I hesitate to make any positive prediction, optimistic or otherwise. At the same time, I think I am safe in saying that BP is well equipped to play its part in meeting the demand for oil, which can be expected to continue increasing throughout the free world.

FINANCIAL HIGHLIGHTS

All figures converted from sterling at $2.80 to the pound.

GROUP SALES PROCEEDS in 1960 totaled $2,623,737,000 as against $2,374,769,000 in 1959. Sales of crude oil and refined products were at an all-time high of 547 million barrels, up nearly 15% from 1959.

GROUP INCOME BEFORE TAXATION amounted to $404,536,000, an increase of $37,854,000 over the previous year's total of $366,682,000, reflecting the gain in tonnage sales.

CONSOLIDATED NET INCOME was $168,955,000 compared with $174,017,000 in the previous year. The decline was due largely to a rise of $41,160,000 in the charge for taxation.

DIVIDENDS for 1960 per £1 ordinary stock unit will total two shillings and four pence (33¢), free of U.K. income tax, upon payment of the final recommended dividend of one shilling and eight pence (23¢).

LIMITED BP BRITANNIC HOUSE · FINSBURY CIRCUS LONDON · E. C. 2 BP

Personals

HORTE

Vern L. Horte, manager of gas supply for Trans-Canada Pipe Lines, Ltd., has been named a director of Alberta Gas Trunk Line Co. He succeeds **N. E. Tanner,** president of Merit Oil, Ltd., as representative of the gas-export companies on the Alberta Gas Trunk Line board.

Fred G. Burgess, engineer with Humble in Great Bend, Kans., has been transferred to Durango, Colo., in the same capacity.

Robert H. Smith, Freeport, Tex., has been transferred from Dow Chemical Co.'s Texas division to Dow International in Midland, Tex., where he will be assistant to the operations manager.

Charles Tallard, senior research geologist for Continental Oil Co. in Ponca City, Okla., has been promoted to assistant Catco region geologist. He will headquarter in Houston.

Elroy P. Waltzer, maintenance supervisor at Du Pont's Sabine River works, Orange, Tex., has been named division maintenance superintendent. **Wiley C. Wright** has been named maintenance supervisor.

J. B. Hundley, Jr., chief development engineer for Richfield Oil Corp., was elected president of the Pacific Coast district of API's Division of Production at the group's recent annual meeting in Los Angeles. He succeeds **Floyd Schoonover,** Monterey division of Humble. Other new officers include area vice chairmen: **J. M. Billings,** Richfield Oil Corp., Los Angeles basin; **Harold Boyd,** OCO Tool Co., coastal area; **F. M. Kalenborn,** Standard Oil Co. of California, San Joaquin Valley; and **Lester Neblett,** California Standard, Coalinga - Kettleman area. **C. R. Ball,** Ball & Black Supply, was re-elected treasurer. **Mrs. Elsie Edmiston** will continue as secretary. **G. L. Laurent,** California Standard, is chairman of the advisory committee and **R. A. Malott,** Shell Oil Co., is vice chairman. Citations for outstanding service presented at the annual meeting went to **R. B. Hodgson,** Tidewater Oil Co.; **R. H. Newman,** Long Beach Oil Development Co.; **Floyd E. Schoonover,** Monterey division of Humble; and **E. E. Embury,** Guiberson Corp.

HUNDLEY

George W. Thompson, area engineer for Texaco in McLeansboro, Ill., has been promoted to assistant reservoir engineer in Salem, Ill.

F. T. Davies, vice president of Gulf European Co., has been named senior vice president. Davies is also a director of Gulf Oil (Great Britain) and Kuwait Oil Co.

Johnny Mitchell, Houston independent operator, was named "Chief Roughneck, 1961" and an honorary life member of the Roughnecks' Club at TIPRO's annual meeting last week in Midland, Tex.

Frank Gardner, exploration editor of The Oil and Gas Journal, has been elected president of Tulsa Geological Society. He succeeds **Bill O. Andress,** Blackwell Oil & Gas Co. Other new officers include **Bernard N. Rolfe,** Sinclair Research, Inc., first vice president; **James M. Forgotson, Jr.,** Pan American Petroleum, second vice president; **Joseph K. Morgan,** Skelly Oil Co., secretary; **Terry Koontz,** Oklahoma Natural Gas Co., treasurer; and **Norman S. Morrisey,** AAPG, editor. **Charles W. Oliphant,** Tulsa independent; **R. O. Dunbar,** Phillips Petroleum Co., Bartlesville; and **Charles Carlson,** Tulsa consultant; were named counselors. Honorary memberships in the society were granted to **Walter E. Hopper,** National Associated Petroleum Co.; **L. M. Neumann,** consultant; **Glenn S. Dille,** consultant; **John L. Ferguson,** Buffalo Petroleum Corp.; and **Ray L. Six,** Oklahoma State University. Posthumous honorary membership award was made to the late Paul Fitzgerald, Dowell division of Dow Chemical Co.

Otto Brown, senior geologist with Gulf Oil in Durango, Colo., has retired and will set up consulting offices in Durango.

New members appointed to the Libyan Petroleum Commission are **M. Abdulkafi al-Smeen, Mohammed Ibrahim al-Meiet,** and **Abdulosman Musbah.**

Travis E. Payne, process engineer with Cities Service Petroleum Co. in Ponca City, Okla., has joined Westland Oil Co. in Williston, N. D., as chief chemist.

Richard F. Shaw, geologist with Berg & Buck Drilling Co. in Shawnee, Okla., and **E. L. Stewart, Jr.,** land man with Humble, have formed Sigma Oil & Gas Co., consulting firm, in Shawnee.

J. K. Jamieson has been elected vice president, a director, and member of the executive committee of Humble Oil & Refining. His election brings Humble board membership to 11. Jamieson has been president and a director of International Petroleum Co. since 1959 and was vice president and a director of Imperial Oil before that time. The new appointment is effective June 1. Jamieson will move to Houston from Miami.

Walter B. Gilbert, Denver division sales manager for Texaco Inc., has been named general sales manager for the southern sales region. He will headquarter in Houston. Gilbert succeeds **Russell R. Kibbe,** who has retired after 41 years with the company.

E. L. Stenzel, production engineer in Dow Chemical Co.'s Louisiana division, Plaquemine, has been promoted to production supervisor in polyethylene. **H. J. Brou,** mechanical development engineer, has been named group supervisor in engineering and maintenance and **J. A. Carter, Jr.,** senior instrument specialist, has been promoted to maintenance supervisor, engineering and maintenance.

▶▶▶ Personals

Robert L. Rorschach, senior process engineer with Warren Petroleum Corp., has joined the atomic and process-equipment division of A. O. Smith Corp. in Tulsa. He will organize a process - engineering group to find applications for the company's low-temperature refrigeration (ASIR) process. Rorschach is chairman-elect of the Tulsa section of AIChE.

Fred E. Smith, Jr., geologist with Ohio Oil Co. in Paso Robles, Calif., has been transferred to Bakersfield, Calif., in the same capacity.

R. P. Hooper, manager of British American Oil Co.'s product-supply division, has been named manager of Gulf Eastern Co.'s product-supply department, a new position. He will headquarter in London.

Donald J. Harrington, assistant head of the chemical-technical service division at Humble's Bayway refinery, Linden, N. J., has been assigned to Enjay Chemical Co. as planning coordinator in the industrial-chemicals division. **George Swisher,** unit supervisor of cracking and light ends in the process division at Bayway, will succeed Harrington.

New assignments for Canadian Husky Oil and Husky Oil Co. executives follow consolidation of the two companies' operations. **W. E. Powell,** vice president of Canadian Husky, will direct land, exploration, production, and pipeline activities in the U. S. and Canada. **T. G. Wise,** vice president of refining and marketing for the U. S. company, will be vice president, marketing. **L. J. Campbell,** vice president in charge of Canadian refineries, will be in charge of all refineries. **J. D. Winzenried,** assistant to the president, has been named vice president in charge of long-range planning and organization development. Financial affairs of both companies will be managed by **Arnold Larsen,** vice president of Canadian Husky. **E. J. Husemann,** formerly treasurer of the U. S. company, has been named a vice president.

B. W. Miller, senior geologist in New Orleans for Gulf Oil, has been promoted to area exploration manager in Casper, Wyo. **J. D. Mackay,** petroleum engineer in Denver, has been named Casper area engineer.

Arne Eriksen has joined H. K. Ferguson Co. as district contract manager in San Francisco. He will be in charge of sales of engineering and construction contracts for the western United States and Pacific area.

Alfred P. Frame, senior vice president and a director of Cities Service Co., will receive an honorary degree of doctor of science from Clarkson College of Technology, Potsdam, N. Y., next month. Frame will be speaker at commencement exercises June 4.

Edward L. Steiniger, president of Sinclair Oil Corp., has been named chief executive officer of the company, succeeding **P. C. Spencer,** chairman. Steiniger and Spencer retain their positions of president and board chairman. Spencer also has been named chairman of the executive committee. Other members of this new committee are Steiniger; **J. F. Dyer,** vice chairman of the committee and the board; **Harry Jeffries,** chairman of the finance committee; **O. P. Thomas,** executive vice president; **T. B. Kimball,** executive vice president; and **George Leness,** a director.

STEINIGER

SPENCER

Jack W. Hudson, vice president in charge of engineering and field operations for Britalta Petroleums, Ltd., Calgary, has been elected vice president and general manager. He succeeds **Claude E. Peavy,** retired. **Nate Goodman,** formerly with J. H. Wilson & Associates, has joined Britalta as production superintendent. **L. E. Riffe,** Riffe Petroleum Co., Tulsa, has been elected a director of Britalta.

Paul G. Benedum, vice president and a director of Plymouth Oil Co., has been elected president and chief executive officer. He succeeds **Walter S. Hallanan,** who has been elected chairman. Benedum is also president of Hiawatha Oil & Gas Co. and Penn-Ohio Gas Co. Hallanan had been president of Plymouth since the company was founded in 1923 by the late Mike Benedum. Paul Benedum is the nephew of the famous wildcatter, who died in 1959.

BENEDUM

Jess H. Robinson has been elected vice president of marketing for Century Refining Co. He had been marketing manager for the company, a subsidiary of Panhandle Eastern Pipe Line Co.

Leonard M. Berger has been elected president of Sinclair Caribbean Oil Co., a subsidiary of Sinclair Oil Corp. Berger formerly was president of Sinclair Cuba Oil Co. SA.

James H. Ransom, Albuquerque district geophysicist for Sinclair Oil & Gas Co., has been promoted to division geophysicist in Fort Worth. **Francis D. Raffalovich,** senior geophysicist in New Orleans, has been transferred to Albuquerque to succeed Ransom.

D. E. Nisley, Ardmore, Okla., division geologist for Continental Oil Co., has been named assistant regional geologist in Oklahoma City. **R. W. Allen,** assistant division geologist, will succeed Nisley in Ardmore.

Edward C. Mitchell, assistant to Texaco's vice president, foreign operations department, Eastern Hemisphere, has been appointed assistant to the senior vice president. Mitchell has been with Texaco since 1935 and has served as manager in Haiti, Jamaica, and Brazil and as assistant general sales manager of the central region in Chicago.

Personals

Hein I. Koolsbergen, coordinator of oil operations for Newmont Mining Corp., has been elected president of Oil Shale Corp. He succeeds **H. E. Linden,** founder of the company, who becomes chairman of the executive committee. **Nathan W. Levin,** investment manager, has been named vice chairman of the board. Headquarters of the company will be moved from Beverly Hills, Calif., to New York.

KOOLSBERGEN

Primo L. Pinotti, senior product engineer in the product-engineering department of Standard Oil Co. of California, has been transferred to Oronite division of California Chemical Co., a subsidiary, as product specialist, petroleum chemicals.

J. M. P. Bongaerts, Shell Indonesia, has been named executive director of Nederlandse Aardolie Mij., Dutch exploration and production company which is jointly owned by the Royal Dutch-Shell group and Standard Oil Co. (N. J.). The appointment is effective November 1. Bongaerts succeeds **Dr. H. A. Stheeman,** who is retiring.

James A. Goolsbee and **Dixon H. Cain** have organized Goolsbee, Cain & Associates, chemical and petroleum engineering consulting firm, in Houston. Goolsbee had been chief process engineer for Tellepsen Petro-Chem Constructors. Cain was president of Fifteen Oil Co., Houston, before its merger with Tennessee Gas Transmission.

W. P. Bush, superintendent of Marathon Pipe Line Co.'s Bridgeport, Ill., gathering district, has been named manager of the tri-state region with headquarters in Bridgeport. He succeeds **Earl S. Mardis,** who will retire June 1 after 43 years with the company.

James F. Babb, measurement engineer for Tennessee Gas Pipeline Co., has been transferred to Wharton, Tex., from Hamburg, N. Y.

D. F. Donnell, plant superintendent at Lone Star Gas Co.'s Temple, Tex., compressor station, has been named superintendent of the Groesbeck, Tex., compressor station. He succeeds **J. P. Haynie,** who has retired. **T. B. Ernest,** plant superintendent in Ranger, Tex., will succeed Donnell in Temple.

Baxter D. Goodrich, senior vice president, gas division, for Texas Eastern Transmission Corp., and **Walter E. Caine,** vice president of the gas-sales department, have been transferred to Houston from Shreveport, La.

Leonard Farabee, engineer for United Gas Pipe Line Co., has been transferred to Aqua Dulce, Tex., from Lafayette, La.

Denver S. Patton, Jr., senior assistant engineer for Texas Eastern Transmission Corp., has been promoted to engineer in the gas division engineering department. He will headquarter in Shreveport, La.

Edwin Fisher has been named operations manager for Anchorage Natural Gas Corp. He succeeds **Howard Hole,** who had served as acting manager. **James Edwards** has been named assistant general manager for construction and operations.

Virgil W. Meythaler and **Franklin K. Rader, Jr.,** vice presidents of Texas Gas Transmission Corp., have been elected senior vice presidents.

Phillip A. Gass, senior vice president of Northern Natural Gas Co., Omaha, has been elected a director of Transwestern Pipeline Co. Northern Natural acquired 16% interest in Transwestern earlier this year through purchase of Monterey Oil Co.'s shares in the Texas-to-California gas transmission system.

C. Ray Grosvenor has joined Williams Brothers Co. to conduct special studies of diversification possibilities in the petroleum processing and transportation field. He will headquarter in Tulsa. Grosvenor formerly was manager of Lucey Products Corp.'s refining, chemical plant, and pipeline department.

P. C. Kenton, assistant purchasing agent with Warren Petroleum Corp., has been elected president of the Purchasing Agents Association of Tulsa. Other new officers are **G. B. Fox,** Sinclair Oil & Gas Co., first vice president; **N. V. Webster,** National Tank Co., second vice president; **I. W. Scott,** Sunray Mid-Continent Oil Co., secretary-treasurer; and **E. J. Jameson,** Humble, national director.

Jerome Green has joined American Oil Co.'s research and development department in Whiting, Ind., as a senior project chemist.

Deaths

E. P. Campbell, 64, president of Western Drilling Co. and owner of E. P. Campbell Drilling Co., died May 9 at his home in Lubbock, Tex., of a heart ailment.

Louis Zellman, 75, Allegan, Mich., president of Zellman Oil Co., died May 11.

Paul F. Goldberg, 67, Evansville, Ind., independent operator, died May 6 at his home.

Charles Roberts Stewart, 49, a supervisor in the production-research section of Pan American Petroleum's Tulsa research center, died May 16 at his home in Tulsa of cancer. Stewart had been with the Tulsa research center since 1940.

Thomas B. Swartzfager, 82, retired Shippenville, Pa., drilling contractor, died May 14 at his home.

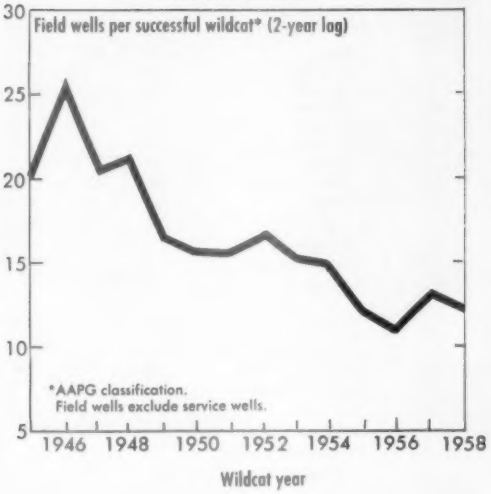
Charles W. Swanson, 85, retired independent producer, died May 13 at his home in Tulsa.

W. L. Shaffer, 76, president of Shaffer Oil Co., died May 13 at his home near Burlington, Kans.

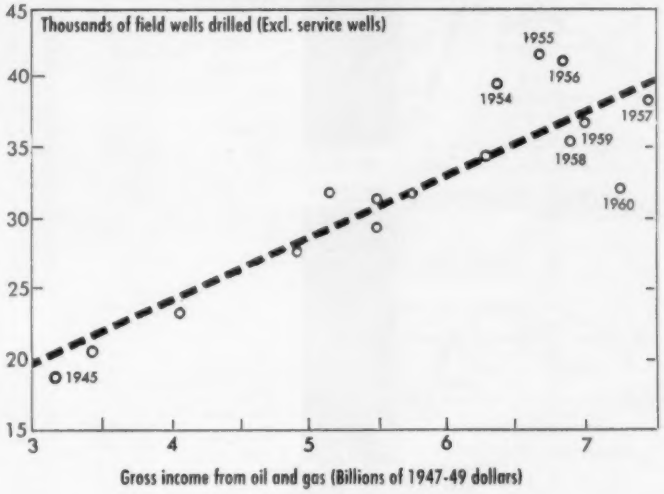
Arthur J. Barton, 63, head of oil-rig construction for Shell Oil Co. in Long Beach, Calif., for 34 years, died May 6.

Development drilling depends on

DISCOVERIES . . .



. . . and PRODUCER INCOME



Development drilling starts with a wildcat

BY JOHN C. CASPER

BEFORE you can drill a development well, someone has to discover a new field or new pool. It follows that the number and quality of discoveries made this year will become an important factor in development drilling during this decade.

Operators have drilled 696,400 wells in this country over the past 15 years. If we use the AAPG classification of exploratory wells, about 25% of the drilling has been in the search for new oil or gas. This classification includes extensions, new pools, new deeper pays, new shallower pays, and new fields.

On this basis, about 25% of all postwar wells would be classified as exploratory. Also, about 19.6% of these exploratory wells found enough oil or gas to be classified as successful.

These successful exploratory wells provided the locations for much of the development drilling in the postwar period. Many economists have used this series as one of the factors in projecting drilling rates for the coming years.

The ratio of development drilling to successful wildcats is pictured by the line on the left chart above. A period of 2 years is allowed for the lag between discovery and peak of development drilling. Also, service wells have been excluded from development drilling since secondary-recovery projects are not closely related to discoveries.

Smaller Discoveries

Note that there has been a general decline in development drilling per discovery. The peak for early postwar period was due to crude shortage and to restricted drilling in late war years. Continuing decline in recent years is related to size of discoveries.

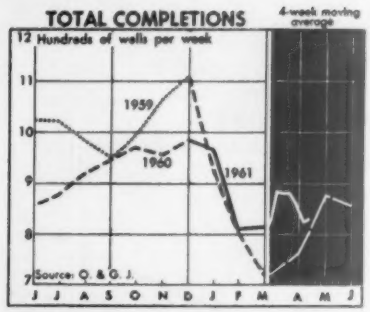
The chart on the right shows a definite relationship between producer income and the number of development wells drilled. Note that income for 1960 was lower than for 1957, after correction for inflation.

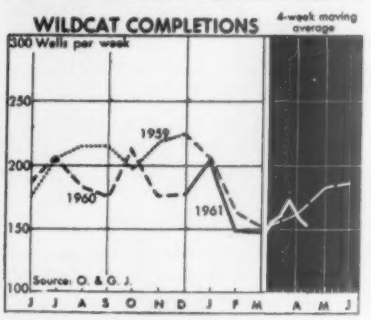
Proration also affects development drilling through changes in income and shifts to nonprorated areas. Even population changes have some influence on drilling through growth in petroleum demand.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,022,925	DOWN	119,475	UP	197,559
Crude stocks	252,180,000	UP	580,000	DOWN	8,345,000
Completions	831	UP	23	DOWN	126
Refinery runs	7,906,000	UP	28,000	DOWN	128,000
Gasoline stocks	216,066,000	DOWN	666,000	UP	7,000
Kerosine stocks	27,090,000	UP	193,000	UP	5,143,000
Distillate stocks	85,530,000	UP	673,000	DOWN	403,000
Residual stocks	43,354,000	UP	1,639,000	UP	5,091,000
Four-product stocks	372,040,000	UP	1,839,000	UP	9,838,000
Total imports	1,613,600	DOWN	54,300	UP	32,800

Active Rotary Rigs





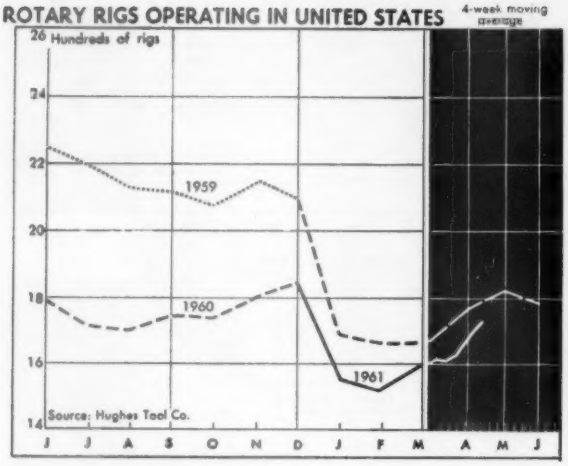
	5-15-61	5-8-61	5-16-60
Alabama	6	6	5
Alaska	9	9	5
Arkansas	11	12	11
Arizona	0	0	1
California	87	88	98
Land	81	82	93
Offshore	6	6	5
Colorado	20	21	25
Florida	0	0	1
Land	0	0	1
Offshore	0	0	0
Georgia	2	2	0
Illinois	31	42	47
Indiana	7	10	6
Kansas	92	89	122
Kentucky	4	7	5
Louisiana	274	278	281
North	34	40	40
S. Inland waters	107	107	116
S. Land	80	71	75
Offshore	53	60	50
Michigan	25	22	38
Mississippi	53	56	55
Missouri	1	1	2
Montana	23	22	20
Nebraska	32	42	28
New Mexico	106	106	113
New York	0	0	1
North Dakota	15	18	15
Ohio	7	8	4
Oklahoma	194	215	171
Oregon	0	0	1
Pennsylvania	6	6	11
South Dakota	1	1	0
Texas	652	626	655
S. Inland waters	9	7	8
S. Land	176	167	177
Offshore	2	2	2
North	65	61	41
Panhandle	55	55	53
East	84	78	62
West Central	160	160	204
West	101	96	108
Utah	31	28	26
Washington	1	1	0
West Virginia	7	6	3
Wyoming	43	53	62
Total U. S.	1,740	1,775	1,812
Cum. avg. to date	1,605	1,597	1,718
Western Canada	80	79	119
Eastern Canada	0	0	2
Grand total	1,820	1,854	1,933

Hughes Tool Co. report.

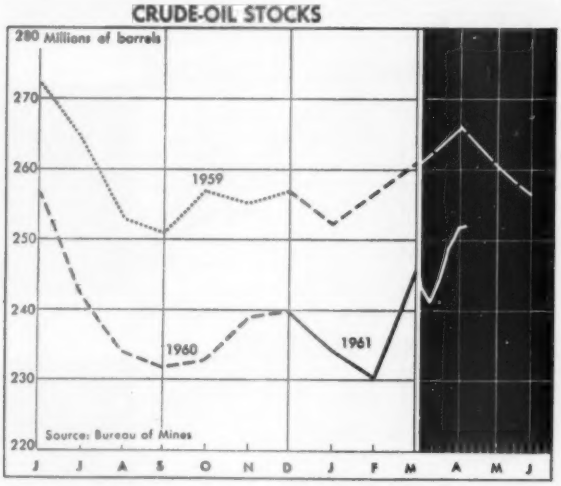
WEEKLY WELL COMPLETIONS . . . WEEK ENDED MAY 13, 1961

	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1961	1960	Total	Crude	Cond.	Gas	Dry	1961	1960
Alabama	6	5	0	0	1	0	69,674	26	20	1	0	0	0	1	5	1
Alaska	0	0	0	0	0	0	0	13	. . .	0	0	0	0	0	2	. . .
Appalachian	18	1	0	16	1	0	45,545	755	650	0	0	0	0	0	19	17
Arizona	0	0	0	0	0	0	0	8	6	0	0	0	0	0	6	6
Arkansas	13	4	0	1	7	1	51,864	199	223	3	0	0	0	3	35	57
California	29	19	0	3	7	0	148,246	619	481	6	0	0	0	6	98	108
Colorado	13	4	0	0	9	0	64,369	246	252	5	0	0	0	5	118	121
Illinois	84	16	0	0	11	57	174,207	638	691	5	0	0	0	5	124	171
Indiana	9	1	0	0	8	0	11,952	212	318	6	1	0	0	5	63	128
Kansas	87	46	0	9	27	5	239,461	1,945	1,148	16	0	0	2	14	360	374
Kentucky	16	4	0	5	6	1	14,683	546	616	1	0	0	0	1	61	74
Louisiana	62	17	9	12	24	0	475,952	1,320	1,200	13	0	0	2	11	199	181
North	24	7	0	7	10	0	64,044	437	371	5	0	0	0	5	73	74
South	34	8	9	5	12	0	374,784	675	628	7	0	0	2	5	109	94
Offshore	4	2	0	0	2	0	37,124	208	201	1	0	0	0	1	17	13
Michigan	11	7	0	0	4	0	33,072	242	262	3	1	0	0	2	98	81
Mississippi	14	7	2	0	5	0	139,145	201	284	3	0	0	0	3	65	90
Montana	5	2	0	0	3	0	38,188	138	91	2	0	0	0	2	62	40
Nebraska	23	10	0	0	13	0	105,888	331	296	9	2	0	0	7	139	115
New Mexico	31	17	0	10	4	0	158,075	634	669	1	0	0	0	1	116	93
West	12	3	0	8	1	0	64,753	252	225	0	0	0	0	0	37	20
East	19	14	0	2	3	0	93,322	382	444	1	0	0	0	1	79	73
North Dakota	4	0	0	0	4	0	28,182	86	107	3	0	0	0	3	24	18
Ohio	21	15	0	0	5	1	44,088	375	383	1	0	0	0	1	18	19
Oklahoma	88	49	4	12	15	8	369,215	2,116	1,390	14	5	3	1	5	217	260
Texas	279	128	20	11	99	21	1,236,345	5,156	5,901	47	2	0	0	45	1,050	1,185
District 1	14	5	0	0	9	0	33,621	320	421	8	0	0	0	8	108	142
District 2	12	4	2	0	6	0	104,704	250	270	0	0	0	0	0	53	64
District 3	18	6	3	0	9	0	139,895	375	461	3	0	0	0	3	77	86
District 4	28	6	2	1	19	0	143,109	427	430	11	0	0	0	11	97	125
East	20	10	5	0	5	0	83,339	419	443	3	0	0	0	3	92	91
District 7-B	38	9	0	1	23	5	105,107	743	862	7	0	0	0	7	200	248
West	74	49	2	2	16	5	365,884	1,294	1,550	10	1	0	0	9	283	245
District 9	50	24	5	1	9	11	144,316	854	1,094	3	1	0	0	2	100	158
District 10	25	15	1	6	3	0	116,370	474	370	2	0	0	0	2	40	26
Utah	2	1	0	1	0	0	10,946	99	106	0	0	0	0	0	40	39
Wyoming	16	8	0	2	5	1	73,260	360	356	4	0	0	0	4	130	150
Miscellaneous	0	0	0	0	0	0	0	86	56	0	0	0	0	0	79	45
Total U. S.	831	361	35	82	258	95	3,532,357	16,351	15,506	143	11	3	5	124	3,128	3,373
Total prev. week	808	403	15	80	272	38	3,085,761	. . .	. . .	141	12	1	5	123	. . .	. . .
Cum. 1961	16,351	7,492	361	1,584	5,843	1,071	66,523,825	. . .	. . .	3,128	250	39	146	2,693	. . .	. . .
Cum. 1960	15,506	7,290	498	1,282	5,985	451	68,187,219	. . .	. . .	3,373	303	36	109	2,925	. . .	. . .
Western Canada	40	18	0	7	15	0	216,998	845	830	0	0	0	0	0	251	253

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	5-6-61	4-29-61	5-7-60
Pennsylvania	2,245	2,143	2,187
Other Appalachian	1,378	1,335	1,793
Illinois, Indiana, Michigan	9,497	9,341	9,823
Nebraska and North Dakota	2,891	3,141	2,810
Kansas	9,407	9,305	10,070
Oklahoma	17,294	16,854	17,968
Arkansas	1,991	2,005	2,108
Louisiana	20,702	20,856	19,868
North	3,501	3,562	3,168
South	17,201	17,294	16,700
Mississippi, Alabama, Florida	2,004	2,311	2,318
New Mexico	7,845	7,720	7,568
Texas	107,923	108,195	110,021
East Texas	9,218	9,342	8,511
West Texas	48,532	49,272	49,495
Texas Gulf	19,144	19,255	19,790
Other Texas	31,029	30,326	32,225
Wyoming	18,343	18,456	17,802
Other Rocky Mountain	9,736	9,828	9,987
California	25,753	25,152	28,319
Foreign	†15,171	14,958	17,883
Total	**252,180**	251,600	260,525

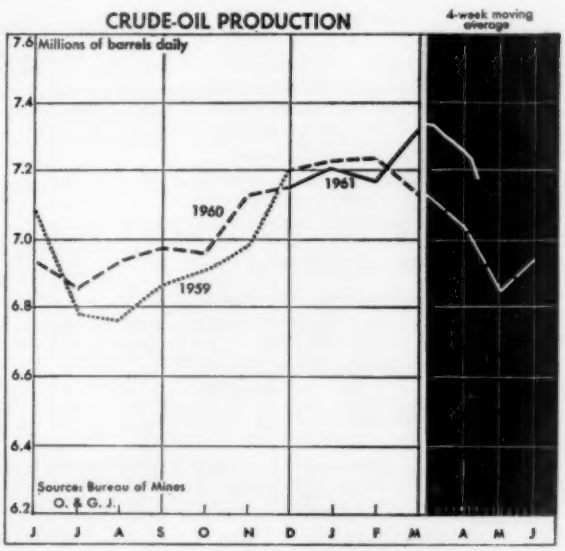
*Bureau of Mines. †Includes 4,890,000 bbl. in California.

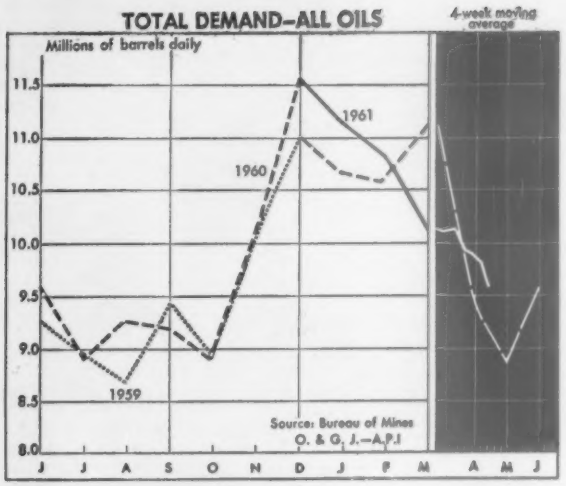
DAILY AVERAGE PRODUCTION FOR WEEK

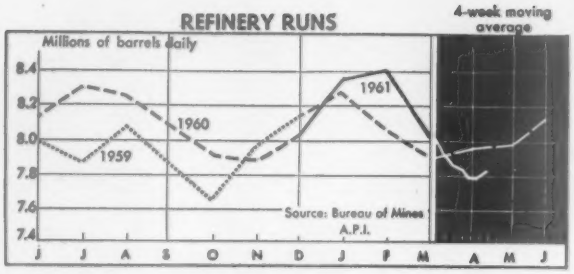
	May 13, 1961 Crude oil	Lease condensate	Total	May 6 total
Alabama	19,325	.....	19,325	19,300
Alaska	12,600	.....	12,600	12,500
Arkansas	82,700	100	82,800	82,750
California	826,000	.....	826,000	827,500
Colorado	132,400	.....	132,400	132,000
Eastern	41,200	.....	41,200	40,300
Florida	1,100	.....	1,100	1,100
Illinois	215,300	.....	215,300	208,100
Indiana	30,900	.....	30,900	30,700
Kansas	†296,450	.....	†296,450	†322,425
Kentucky	49,200	.....	49,200	49,200
Louisiana	1,019,025	143,525	1,162,550	1,158,250
North	104,025	6,025	110,050	110,025
South	915,000	137,500	1,052,500	1,048,225
Michigan	52,500	.....	52,500	52,700
Mississippi	145,975	4,200	150,175	150,450
Montana	82,000	.....	82,000	82,500
Nebraska	67,300	.....	67,300	67,500
Nevada	450	.....	450	450
New Mexico	310,000	7,300	317,300	315,600
North Dakota	61,300	.....	61,300	62,000
Oklahoma	†512,400	.....	†512,400	†559,700
Texas	2,355,000	93,350	2,448,350	2,501,200
Dist. 1	43,000	2,400	45,400	45,975
Dist. 2	97,000	8,400	105,400	109,100
Dist. 3	298,000	39,000	337,000	341,000
Dist. 4	167,000	13,800	180,800	185,950
Dist. 5	26,000	600	26,600	27,175
Dist. 6	104,000	8,400	112,400	116,400
East Texas field	124,000	.....	124,000	127,425
Dist. 7-B	120,000	400	120,400	123,550
Dist. 7-C	108,500	3,150	111,650	114,075
Dist. 8	977,000	11,000	988,000	1,012,850
Dist. 9	190,000	3,800	193,800	193,800
Dist. 10	100,500	2,400	102,900	103,900
Utah	70,500	.....	70,500	§76,800
Wyoming	390,100	.....	390,100	388,700
Others	‡725	.....	‡725	‡675
Total U. S.	6,774,450	248,475	**7,022,925**	§7,142,400
Change from prev. week, down			**119,475**	
Canada	†615,000	.....	†615,000	†538,000
Total U. S. prod.—Jan. 1-May 13			965,229,000 bbl.	
Same period last year (crude plus cond.)			*955,048,700 bbl.	

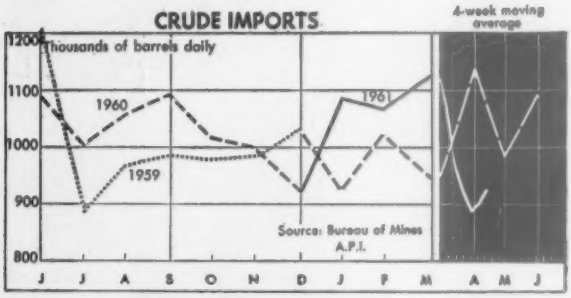
*Includes 31,210,300 bbl. condensate. †Week ended previous Monday. ‡South Dakota and Arizona. §Revised.

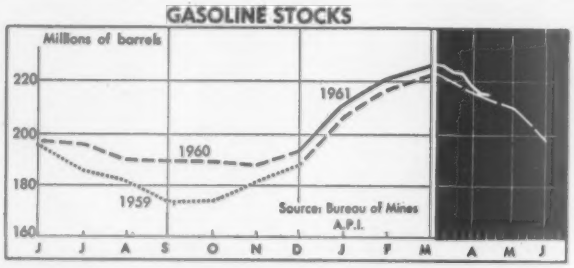
CRUDE-OIL PRODUCTION

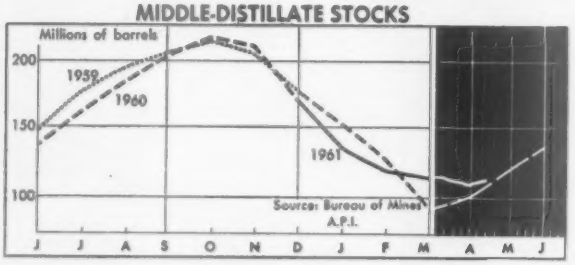


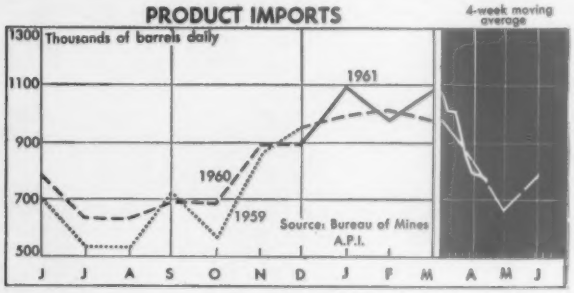


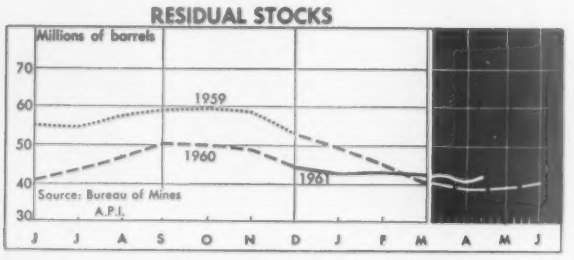












API REFINERY REPORT, MAY 12, 1961

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, May 1960 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,096	501.0	22.4	319.4	147.0	50,227	9,853	24,387	11,289	1,129	490.9	31.7	317.3	149.4
Appalachian:														
District 1	94	39.7	3.6	20.7	9.3	6,179	658	1,779	398	97	39.0	3.6	21.4	7.6
District 2	97	51.9	3.6	19.7	13.0	3,061	382	904	360	74	43.9	1.1	15.4	5.7
Ind., Ill., Ky.	1,330	689.9	63.3	240.6	137.4	40,656	4,716	14,794	5,107	1,424	734.4	66.9	283.7	136.3
Minn., Wis., Dak.	55	23.0	1.0	9.3	11.7	6,737	498	3,415	565	120	57.9	4.4	29.7	15.8
Okla., Kans., Mo.	673	369.3	14.3	147.0	19.1	19,441	1,339	8,770	895	692	381.8	16.6	157.2	20.7
Inland Texas	297	208.4	9.6	51.6	18.0	8,406	553	1,475	2,614	291	213.1	8.0	48.5	18.5
Texas Gulf Coast	1,957	996.7	106.8	413.8	135.9	29,633	3,168	9,305	4,847	1,890	952.8	101.5	426.5	128.2
La. Gulf Coast	701	400.8	21.9	174.1	45.3	10,660	3,148	4,667	1,101	680	348.4	41.2	158.3	41.8
N. La. and Ark.	115	70.4	2.4	26.1	6.3	5,816	527	1,865	114	110	65.0	5.8	22.9	4.4
Rocky Mountain:														
New Mexico	24	11.3	0.6	5.4	2.3	767	57	187	72	24	11.8	0.5	4.1	2.6
Other Rocky Mt.	268	128.4	7.4	56.7	29.1	7,640	382	2,290	886	244	118.0	2.1	60.0	30.0
West Coast	1,199	562.9	51.4	180.7	293.5	26,843	1,809	11,683	15,106	1,188	532.0	34.4	191.8	280.0
May 12, 1961	7,906	4,053.7	308.3	1,665.3	867.9	216,066	27,090	85,530	43,354	7,963	3,989.0	317.8	1,736.8	841.0
May 5, 1961	7,878	3,924.3	333.0	1,620.0	826.9	216,732	26,897	84,857	41,715	.....	.....	.....	.....	.....
May 13, 1960	8,034	3,994.9	356.6	1,680.3	866.4	216,059	21,947	85,933	38,263	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Oklahoma	West Tex. (sour)	West Tex. (Inter.)	No.* Texas	Texas Refugio Light	Bayou Sale (La.)	Denver Julesburg	Wyo. (sour)
14-14.9	$1.86	....	....	....	....	....	....	....	....
15-15.9	1.93	....	....	....	....	....	....	....	$1.81
16-16.9	2.00	....	....	....	....	....	....	....	1.86
17-17.9	2.06	....	....	....	....	....	....	....	1.91
18-18.9	2.13	....	....	....	....	....	....	....	1.96
19-19.9	2.20	....	(†)	....	....	....	....	....	2.01
20-20.9	2.27	$2.49	$2.35	$2.61	$2.29	$2.95	$2.90	$2.58	2.06
21-21.9	2.33	2.52	2.38	2.63	2.33	2.97	2.92	2.60	2.11
22-22.9	2.40	2.55	2.41	2.65	2.37	2.99	2.94	2.62	2.16
23-23.9	2.46	2.58	2.44	2.67	2.41	3.01	2.96	2.64	2.21
24-24.9	2.53	2.61	2.47	2.69	2.45	3.03	2.98	2.66	2.26
25-25.9	2.60	2.64	2.50	2.71	2.49	3.05	3.00	2.68	2.31
26-26.9	2.67	2.67	2.53	2.73	2.53	3.07	3.02	2.70	2.36
27-27.9	2.74	2.70	2.56	2.75	2.57	3.09	3.04	2.72	2.49
28-28.9	2.81	2.73	2.59	2.77	2.61	3.11	3.06	2.74	2.54
29-29.9	2.87	2.76	2.62	2.79	2.65	3.13	3.08	2.76	2.59
30-30.9	2.93	2.79	2.65	2.81	2.69	3.15	3.10	2.78	2.63
31-31.9	3.00	2.82	2.68	2.83	2.73	3.17	3.12	2.80	2.67
32-32.9	3.06	2.85	2.71	2.85	2.77	3.19	3.14	2.82	2.71
33-33.9	3.12	2.88	2.74	2.87	2.81	3.21	3.16	2.84	2.75
34-34.9	3.17	2.91	2.77	2.89	2.85	3.23	3.18	2.86	2.79
35-35.9	3.22	2.94	2.80	2.91	2.89	3.25	3.20	2.88	2.83
36-36.9	3.27	2.97	2.83	2.93	2.93	3.27	3.22	2.90	2.87
37-37.9	3.31	2.99	2.86	2.95	2.95	3.29	3.24	2.92	2.89
38-38.9	....	3.01	2.89	2.97	2.97	3.31	3.26	2.94	2.91
39-39.9	....	3.03	2.92	2.99	2.99	3.33	3.28	2.96	2.93
40-44.9	....	3.05	2.95	3.01	3.01	3.35	3.30	2.98	2.95

*Cooke, Grayson, Montague. †Two buyers announced increase.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.23-3.53
Van	3.08
Pennsylvania Grade:	
Bradford	$4.80
Middle District	4.52
Southwest Pennsylvania	4.25
West Virginia	4.17
Buckeye Grade	4.08
Illinois Basin	**3.00-3.05**

FOREIGN

Middle East, Persian Gulf: (cargoes f.o.b. lifting port)	
Arabian, 34.0°-34.9°, Ras Tanura	$1.80
Iranian, 34.0°-34.9°, Bandar Mashur	1.78
Iranian, 34.0°-34.9°, Abadan	1.73
Iraq, 35.0°-35.9°, Fao	1.72
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.59
Qatar, 41.0°-41.9°, Umm said	1.95
Middle East, E. Mediterranean:	
Arabian, 34.0°-34.9°, Sidon	$2.17
Iraq, Mosul-Kirkuk, 35.0°-35.9°, Tripoli	2.19
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 36°	2.42
Canada:	
Leduc-Woodbend	$2.53
Redwater (Alta.)	2.42
Weyburn (light)	2.06
Midale C	1.70
Venezuela:	
Cumarebo, 47°-47.9°, Tucupido	3.34
San Joaquin, 40°-40.9°, Puerto La Cruz	3.08
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

TANKER RATES (Long Ton)

(Latest reported spot fixtures)

Gulf-NY, clean (ATRS—17.0%)	$2.35
★ Gulf-NY, dirty ATRS—7.5%)	2.64
★ Carib.-NY, dirty (ATRS—60%)	1.10
★ PG-UK, dirty (Scale—69%) (21s. 7d.)	3.02
PG-Japan, dirty (USMC—80%)	2.04

★Denotes change from previous week.

REFINED PRODUCTS

Following quotations are realistic spot prices for refined products moving interstate on Wednesday each week. They may differ from refiners' posted prices and should not be considered as postings.

Light-product prices are in cents per gallon. Residual and crude prices are dollars per barrel. Crude prices are at the well unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	11.50-12.00
Premium (99 octane)	14.25-14.50
Natural gasoline (26-70)	4.5
Breckenridge	4.0
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.50-11.00
Regular (92 octane)	10.75-11.25
Premium (98 octane)	11.75-12.25
California (rack) Los Angeles:	
Regular (90 octane)	11.00
Premium (94 octane)	12.00
Premium (100 octane)	13.50
Caribbean area (cargoes):	
Regular (87 octane)	9.125
Premium (97 octane)	11.50

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	10.00-10.25
Diesel oil (58 d.i. and above)	9.75-10.00
Distillate No. 1	9.50-10.00
Distillate No. 2	8.50-9.00
Gulf Coast (cargoes):	
Kerosine 41-43	9.25-9.50
Distillate No. 2	8.25-8.75
New York Harbor (barges):	
Kerosine 42-43	*11.40
Distillate No. 2	*10.40
Diesel fuel, 48-52 d.i.	*10.55
Caribbean area (cargoes):	
Distillate No. 2	8.625

*Subject to 0.5 cent discount.

RESIDUAL FUEL (Bbl.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$1.70-1.80
Gulf Coast (cargoes):	
★ Bunker C fuel	2.10
New York Harbor (barges):	
Bunker C fuel	2.52
Caribbean (cargoes):	
Bunker C fuel	2.00
California (rack):	
Bunker C fuel, Los Angeles	2.25

CLASSIFIED ADVERTISING

. . . your market place

for the oil and gas industry

RATES:

UNDISPLAYED CLASSIFIED 30c a word per issue. 10% discount three or more consecutive issues. $5.00 minimum charge. Blind Box in our care nine words.

DISPLAY CLASSIFIED
$20.00 a column inch one issue . . . 10% discount three or more consecutive issues.

Address Classified Advertising Material: The Oil and Gas Journal, P. O. Box 1260, Tulsa 1, Okla. **All ads payable in advance.**

EXCEPT . . .

WESTERN STATES: (California, Washington, Oregon, Idaho, Nevada, Utah, and Arizona). Write: Classified Departments, Inc., The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles 8, Calif. Phone AXminister 2-0287.

FOR SALE EQUIPMENT

2—INTERNATIONAL K11 tandem trucks equipped with triplex HP acid pumps, tanks, flexible hose, connections and air brakes. These pumpers excellent for many lease service operations. Selling price based on salvage value, price $7,500.00 each. Terms or lease purchase for qualifying buyers. Write or call C. D. Core, P. O. Box 47, Phone FR 9-5132, Seguin, Texas

FOR SALE EQUIPMENT

WILL SACRIFICE! All offers considered. 800 HP Worthington, LT6 Compressor. Box M-381, The Oil and Gas Journal, Tulsa, Oklahoma.

FOR SALE: 7,000 feet N-80 Tubing with Reed work-over Tool Joints. $1.25 per foot. Box 456, Rangely, Colorado. Phone 127.

FOR SALE EQUIPMENT

NEW AND USED Skid Hydraulic Casing Pulling Units for sale. GLadstone 3-6551. Great Bend, Kansas.

AN INVESTMENT! Productive advertising is an investment rather than an expenditure. Experienced oil men have found that The Oil and Gas Journal is their best classified advertising medium.

FOR SALE
GASOLINE PLANT EQUIPMENT
Bishop, Texas

Absorbers—1250# to 2100# w.p.
Towers—150# to 2000# w.p.

VESSELS, PRESSURE TANKS, REBOILERS, ELECTRIC MOTOR-DRIVEN CENTRIFUGAL AND RECIPROCATING PUMPS—ATMOSPHERIC COOLERS—HEAT EXCHANGERS—COMPRESSOR CYLINDERS—BOILERS—METERS—REGULATORS—MISCELLANEOUS TANKS INCLUDING 10,000-BBL. FLOATING ROOF.

All Material Excellent Condition
Complete Inventory Available on Request

Mid-States Pipe and Supply Co.
P. O. Box 2534 Phone LUther 2-9128
Tulsa, Oklahoma

FOR SALE

14—G-R, Atmospheric Cooling Sections, Type 2-153-240, Model GRX-S, single pass, 900 psig WP. 6—Coynco (NEW) Fin Tube Sections, 2 pass Jacket Water Coolers, 446 sq. ft. each.
Compressor Cylinders for Clark Bros., Cooper-Bessemer and Ingersoll-Rand Gas Engine Compressors.

Write or call:
C. J. SMITH
Oil Capital Building, Tulsa, Oklahoma
Phone: LUther 2-5516

LOCATED HOUSTON, TEXAS
(from Amoco Refinery Co., Destrehan, La.)

HEAT EXCHANGERS
50 to 4,000 sq. ft.
VESSELS—TOWERS
12" to 8' dia.
PETROCHEM FURNACES
½MM, 2½MM, 5MM BTU
PUMPS
50 to 7,000 GPM

—WIRE—PHONE—WRITE—

BRILL EQUIPMENT COMPANY
4101 SAN JACINTO ST., HOUSTON 4, TEXAS
35-65 JABEZ STREET, NEWARK 5, N. J.

FOR SALE

1—7¼" x 12" Gardner Denver Pump w/ Cummins Diesel Engine
1—D-300 Emsco Power Pump
1—131' Lee C. Moore Jacknife Derrick & Substructure
6600'—4½" EUE Drill Pipe w/18° taper Flash-welded API Ex Tool Joints

Write for Equipment Inventory.
NOWERY DRILLING COMPANY, INC.
5904 Fairfield Avenue, Shreveport, Louisiana

AT N. LITTLE ROCK, ARKANSAS

3—Worthington #LTC-4 compressors, 3500 CFM @ 45 PSI, 24 x 15, 2-cyl., 500 HP, 4-cycle. gas-engine drive.

Phone POplar 3-3505

PERRY EQUIPMENT CORP.
1402 N. Sixth St.
Philadelphia 22, Pa.

LIQUIDATION

ESSO REFINERY—BALTIMORE, MD.—MOST EQUIPMENT NEW 1956

TOWERS

84" x 39' 16 Trays 178 PSI
54" x 30' 12 Trays 200 PSI NEW
48" x 39' 16 Trays 283 PSI
36" & 6' x 97' 34 Trays 280 PSI
30" x 36' 9" 7 Trays 360 PSI

PETRO-CHEM FURNACES

30.7MM/BTU 19.3MM/BTU
10.4MM/BTU 9.7MM/BTU
7.5MM/BTU 2MM/BTU

NEW 5% CHROME FURNACE TUBES

1,200'-6" ½" Wall 420'-6" ⅜" Wall
114'-5" " " 250'-5" " "
1,030'-4" " " 1,300'-4" " "

DRUMS

12' x 45' 171 PSI NEW
10' x 30' 160 PSI Lead Lined
9' 4" x 38' 345 PSI Refractory
8' 6" x 35' 120 PSI Gunite
94" x 20' 319 PSI Refractory
6' x 33' 175 PSI Gunite
6' x 27' 300 PSI 18-8 SS Screens
6' x 13' 114 PSI NEW

64" x 25' 323 PSI Refractory
5' x 20' 240 PSI NEW
4' x 17' 530 PSI
4' x 14' 250 PSI Gunite
3' x 16' 286 PSI
3' x 13' 300 PSI Gunite
3' x 12' 5" 550 PSI

COMPRESSORS

3—Ingersoll-Rand 510 CFM Hydrogen Recycle Type 2HHE Non-Lubricated Compressors, Single Stage, Double Acting, 2 Cylinder, 500 PSI Discharge, 350 HP Totally Enclosed Inert Gas Filled Motor Drive.
2—Worthington Recycle Gas Boosters 7¾" x 9", Motor Drive.

HEAT EXCHANGERS & CONDENSERS

18-8 STAINLESS STEEL			ADMIRALTY			5% CHROME		
SqFt	Tubes	Shell	SqFt	Tubes	Shell	SqFt	Tubes	Shell
2,320	75 PSI	135 PSI	1,640	100 PSI	145 PSI	1,040	1,500 PSI	110 PSI NEW
1,860	625 PSI	145 PSI	1,350	100 PSI	530 PSI	975	530 PSI	200 PSI
1,150	75 PSI	15 PSI	1,135	100 PSI	230 PSI	573	530 PSI	715 PSI
1,000	100 PSI	50 PSI	1,025	75 PSI	100 PSI NEW	STEEL		
890	100 PSI	75 PSI	665	100 PSI	236 PSI	2,240	840 PSI	260 PSI
615	100 PSI	75 PSI	600	100 PSI	325 PSI NEW	1,040	840 PSI	145 PSI
420	100 PSI	100 PSI	548	100 PSI	200 PSI	890	230 PSI	165 PSI
235	75 PSI	75 PSI	216	100 PSI	260 PSI	485	715 PSI	260 PSI
						238	570 PSI	530 PSI

RECYCLE GAS DRYER

consisting of
2—4' 6" x 11' Recycle Drums 600 PIS
1—1' 4" x 4' 3" Hydrier 230 PSI

CENTRIFUGAL BLOWER

7,500 CFM, 42.5 PSIG with 1,250 HP Synchronous motor

PUMPS

Ingersoll-Rand 400 GPM @ 615'
Pacific 349 GPM @ 2,040' 7 Stage
Pacific 173 GPM @ 738'
Byron Jackson 107 GPM @ 1,460' 12 Stage 410 SS Impeller
Byron Jackson 88 GPM @ 1,750' 8 Stage

Heat & Power Co., Inc.
NEW YORK OFFICE—60 E. 42, N. Y. 17 • MU 7-5280
TULSA OFFICE, 310 Thompson Bldg. Tulsa 3, Okla., LUther 3-4890
SITE OFFICE—Boston & Haven Sts. Baltimore 24, Md., ORleans 5-0595

FOR SALE EQUIPMENT

CORE DRILL SPECIAL—New hydraulic, angle 800' capacity drill. Truck mounted. Ready for service. Bargain price. Pressey and Son. Pueblo, Colorado.

83-72-71 SPEEDSTARS and several Bucyrus cable tool rigs. Also 2—1000 Mayhew and other Rotaries. We have service and repairs for Star and Keystone Machines. Manufacturers of Rotary and Cable tools. Star Drilling Supply Co., Chanute, Kansas.

2 MODERN TRAILER-MOUNTED DRILLING RIGS FOR SALE

Wilson Mogul and National T-12, GMC engines and converters. Complete less drill string—currently operating—Priced to sell.

Bakersfield Calif. Phone FAirview 7-8130

10,000-BARREL TANK

1—10,000-bbl. Pontoon Floating Roof Tank, 42'-6" dia. x 40' high, welded construction. Used for Gasoline Storage, excellent condition. Location: Bishop, Texas.

MID-STATES PIPE AND SUPPLY CO.
703 Philtower Bldg. LUther 2-9128
Tulsa, Oklahoma

A REAL BUY

5,000' Portable Rig—Nearly New

1—Cabot-Franks Comet Model 50 Single Drum Portable Drilling Rig, Model 137 Water-Cooled Drum Assembly, Hydromatic Brake, 96' 200,000# Telescoping Derrick, mounted on Franks Trailer Model T-320X, powered with Twin GMC Diesel Model 12107-T, with Torque Converter, Serial No. 59053-5, rated for 5,000' drilling with 4½" Drill Pipe. This is a repossession—has only drilled one well. Available subject to prior sale at 25% less than new price.

McJUNKIN CORPORATION
1352 Hansford Street, Charleston, W. Va.
Phone DI 4-1761

FOR SALE OR LEASE

NEW LARGE STORAGE TANKS

4—100,000-barrel Cone Roof Tanks 134' dia. x 40' high, fabricated to API Specs, but never erected and used. Suitable oil and other liquid storage. Detailed prints available.

Priced attractively prompt shipment Rome, N. Y., or will erect your location and sell or lease.

MID-STATES PIPE AND SUPPLY CO.
703 Philtower Bldg. LUther 2-9128
Tulsa, Oklahoma

DISMANTLING LARGE OIL REFINERY in TOLEDO, OHIO

2—**Baffle Towers**—Shell 9' ID x 41' x 1¾" Thick Baffles 2 and 2 Trays, Manheads 1-28" + 2-24", Lined—Stainless Steel
2—**Baffle Towers**—Shell 9' ID x 53 x 1¾" Thick, 15 Trays, Manheads—17-16" and 2-24" Lined—Stainless Steel
1—**Baffle Tower**—Shell 5'6" x 4'6" x 62' x ¾" Thick—20 Trays, Manheads 3-20"
2—**Tanks—Shell**—1¼" Thick x 30' x 9' ID, Test Pressure—300# per square inch
4—**Large Stills** with Crome Tubes—4" to 5" OD 36' Long, Large Cast and Steel Valves

All above equipment available for immediate inspection. For further information call or write:

STAR WRECKING COMPANY
4571 288th St. Toledo 11, Ohio
Telephone: RAndolph 6-2001

FOR SALE EQUIPMENT

7¼ x 14 Gardner-Denver type FXK new style mud pump. Real Bargain. R. A. Tidwell, Box 4423, Oklahoma City, Oklahoma.

CLARK MA-4 Gas Compressor, 150 HP, skid-mounted with radiator and accessories; 2 I.R. XVG6 Gas Compressors; 4225 HP Clark Centrifugal Compressor 9920 CFM 240 PSI discharge Pumps; Exchangers; Vessels. Brill Equipment Company, 4101 San Jacinto St., Houston 4, Texas.

EQUIPMENT WANTED

WANTED TO BUY or lease—a double-drum Franks pulling unit on percentage basis. Plenty of work. Contact E. C. Higdon, McCook, Nebraska. Phone 2778.

ONE, TWO, OR THREE 500 or 1,000 bbl. junk tanks. F.O.B. Plainview. Contact R. Morris, 2213 Jolliet, Plainview, Texas.

WANT 25,000 Gallon ¼" Wall or Greater Steel Storage Tanks for Atmospheric Storage. Write: Campbell, Box 91, Midland, Texas.

HELP WANTED

GEOLOGIST

Our Service has been selected by a small oil company with expansion program, to recruit and screen candidates for the above position which offers a fine opportunity for a successful man. Requires 8 or more years experience in South Texas and Louisiana Gulf Coast area, with an independent company desirable. Ability to meet public. Submit Resume. Salary $10,000 Fee Paid.

QUINBY EMPLOYMENT SERVICE
406 Bankers Mortgage Bldg. Houston, Texas

GEOLOGIST with five to eight years experience, mostly in Southern Louisiana, to open Lafayette District Exploration Office. Address statement of education and experience to: H. W. Bass & Sons, Inc., 1150 Mercantile Dallas Building, Dallas 1, Texas.

HELIUM PLANT ENGINEER

B.S. in Chemical Engineering. Up to one year gasoline plant or refinery experience desired but not required. Must be married. Engineer will run product purity analyses, oversee product loading, inspect all plant equipment, function as engineer and foreman. Send resume of education and experience, college transcript, photograph, present salary or salary requirement to:

R. G. Neph, Kerr-McGee Oil Industries, Inc.
KERR-McGEE BUILDING
Oklahoma City, Oklahoma

ASSISTANT MANAGER ELECTRONIC DATA PROCESSING

Need Assistant Manager to establish and write standards for programming new computer and supervise the programming. Must have administrative ability and understand both oil company operating problems and programming techniques. Must be able to consult with executive and administrative personnel in all operating departments. Background required: engineering degree or mathematics degree with two years engineering experience and two years data processing experience or four years data processing experience. Send resume of education and experience, recent photograph and approximate salary requirement to:

R. G. Neph, Kerr-McGee Oil Industries, Inc.
Kerr-McGee Building, Oklahoma City, Oklahoma

HELP WANTED

EXPANDING INDEPENDENT, requires 6-10 experienced reservoir engineers competent in miscible, water, gas drives, and unit engineering committee work. Box 929, Tyler, Texas.

INTEGRATED INDEPENDENT PRODUCER desires man for Lease Records and Rental Department, Houston. Some experience necessary. Send resume, including salary to Box M-388, The Oil and Gas Journal, Tulsa, Oklahoma.

TRANSLATORS—ENGINEERS WANTED. Proven ability to translate technical material into fluent English essential. Attractive full time or free-lance arrangement. All languages of interest, particularly Russian. Send resume to: A•T•S, Inc., Drawer 271, East Orange, N. J.

NATURAL GAS ENGINEER with Engineering Degree plus three to five years experience in process design and gasoline plant operation for work in general office of large, independent operator in Southwest. Reply to Box M-375, The Oil and Gas Journal, Tulsa 1, Oklahoma.

OIL JOB DIRECTORY, foreign and domestic, showing where to apply for jobs. $5.00 cash OIML Co., Box 2603, Tulsa, Oklahoma.

NATURAL GAS Engineer with engineering degree plus 3 to 5 years experince in plant design or operation for work in the Gulf Coast Area. Amerada Petroleum Corp., Gas Department, P. O. Box 2040, Tulsa, Oklahoma.

CHIEF PROCESS ENGINEER

Midwest refiner has opening for Chief Process Engineer. Must have B.S. or M.S. in Chemical Engineering and varied experience in process calculations. General knowledge and understanding of Cat Cracking, Alkylation, Platforming, and utilities desirable. Send complete resume, including salary requirements.

Box M-389, The Oil and Gas Journal
Tulsa, Oklahoma

CHEMICAL ENGINEER

Opening exists for a chemical engineer with up to about 5 years experience in oil refinery process monitoring, control, operations, or process design. Engineer will have access to computer and be taught applications thereon. Engineering aide available part time. Send resume to:

PONTIAC REFINING CORP.
Post Office Box 1581
Corpus Christi, Texas

SITUATIONS WANTED

ELECTRICAL ENGINEER: 35, ten years pipeline station electrical and control design, construction, and startup, foreign and domestic. Box M-397, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, Ph.D., 6 years geological and geophysical experience, domestic and foreign. Multilingual. Desires responsible foreign position. Box M-394, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM ENGINEER, Age 33, Seven years Diversified Experience (Drilling, Workovers, Production, Reservoir Studies). Box M-405, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEER, 42, recently pipelines adviser to foreign national oil company. Background in development, design and construction of products and gas pipelines. Box M-392, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, 36, married, twelve years wide experience Venezuela-subsurface, surface, consulting, desires stable position with challenge and responsibility. Foreign work welcomed. Box M-391, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST—Twelve years experience in various facets of exploration and evaluation. Principal areas of previous work: Rocky Mountains, Eastern Interior, and West Texas. Desires foreign assignment or position with active domestic independent. Box M-407, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION—GEOLOGIST, M. S. married, 35, 10 years experience. Seven years in Venezuela. Nearly bilingual. 3½ years specializing in unitization, joint interest, equity studies. Well versed in general subsurface operations, reserve estimates. Will relocate anywhere in U. S. Resume on request. Box M-406, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY Superintendent—Engineer: 39, 17 years varied experience in refinery process design, construction, maintenance and operation. Registered, engineer in Texas and Oklahoma. Box M-404, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, with twenty years experience including all phases drilling, production, pipeline, engineering and geological evaluatings. Good background in administration and management including budgets, forecasts, economic evaluations, explorations and exploitation. Desire position with progressive independent or small producing firm. Registered. Box M-409, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION WANTED

OIL AND GAS Production wanted. Any Size—Any Where. Box M-378, The Oil and Gas Journal, Tulsa, Oklahoma.

LEASE AND DRILLING BLOCKS

INDEPENDENT production company leasing acreage in Ohio and West Virginia has 5,000 to 15,000 acre blocks. Excellent earning potential for small investors. Write or call: Ohio-West Virginia Production, Box 393, Marietta, Ohio. FR 3-6862.

DO YOU HAVE A LEASE TO SELL? For as little as $5 per week you can tell your proposition to over 45,000 oil men through The Journal's classified advertising pages. You'll be surprised how many are interested.

CAMBRIDGE ARCH, Neb., Active operator seeks associate to develop a number of lease blocks. Some small acreage in Red Willow County. Others expand to several thousand acres, adjacent counties. Write: Box 31 Z 232, The Oil and Gas Journal, 4041 Marlton Ave., Los Angeles, 8, Calif.

OHIO, WEST VIRGINIA and Kentucky oil and gas leases for sale. Large blocks of acreage in competitive areas. Norman L. Botkin, Box 493, Charleston, West Virginia.

FOR SALE

40% interest in estimated 200 billion cubic feet natural gas worth 28 cents per MCF at well head and in heart of large industrial area. Cash or stock. Field now being developed and financed by one of largest natural gas companies.

IRILCO
Box 52, Nassau, Bahamas

Will sell a few "several thousand acre checkerboards" of leases in various areas in Pennsylvania and Ohio where seller will promptly test Oriskany, Helderberg, Medina and deeper formations—no pro-ration—ready market @ 27 cents per M.C.F. Seller willing to participate in drilling deals with responsible buyers. Excellent success record of seller includes recent significant Oriskany gas pool discovery in Ashtabula County, Ohio and "Shearer Oil Pool" discovery in Coshocton County, Ohio in 1952. Write to:

James I. Shearer, President, James Drilling Corporation 250 Newport Road, Blairsville, Pennsylvania

BUSINESS SERVICE

DELAWARE CORPORATION formed and serviced. American Guaranty & Trust Company. P. O. Box 487, Wilmington, Delaware.

"DO IT YOURSELF" cold process natural gasoline plant. Custom engineered process-mechanical flow diagram, equipment specifications less than $2,500. Free cost and production information. Submit details without obligation to: Box M-359, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS OPPORTUNITIES

INDEPENDENT Producer desires associates to join in proven shallow drilling programs this year on a cost basis. For Particulars. Write: Box 589, Independence, Kansas.

DISTRIBUTORS WANTED—For Masterseal line of lost circulation products, Masterseal, Masterbridge, Masterplug, and Masterfiber. Good areas still open. Masterseal Sales Corporation, Box 1501, Ventura, California.

KARL A. RIGGS, Ph. D.
Consultant
National *International*
Exploration & Production Investigations
Appraisals, Management & Reports
723 Penguin Drive Dallas, Texas

Profitable small Texas refinery—making gasoline Diesel, JP4. Has import quota in addition to operating profit, and over $100,000 tax loss carried forward from start-up period. Can double output with present equipment and has spare colums for manufacture of additional products. Principals only.

Box M-408, The Oil and Gas Journal
Tulsa, Oklahoma

FOREIGN OPPORTUNITY for MAJOR U. S. MANUFACTURER

Leading British industrial group with highly diversified manufacturing facilities and broad line of industrial products seeks to expand U. S. affiliations with major manufacturing companies through licenses, sales rights, joint ventures or contract manufacturing. Preference for industrial products sold to basic industries in the oil, gas transmission, petro-chemical, nuclear and power producing fields.

Excellent opportunity for U. S. company seeking to establish itself in the expanding European market.

For further information
Contact U. S. Representative

WILLIAM VANDERSTEEL
50 Broad St., N. Y. 4, N. Y.
WHitehall 4-6975

FINANCING

EXPERIENCED PRODUCER, want associates to drill 500 ft. Bartlesville sand, offset to nice producer. Montogomery County, Kansas. Will furnish references. Box M-320, The Oil and Gas Journal, Tulsa, Oklahoma.

MONEY RAISING

HAVE COMPLETED two nice wells since first of year. Have three more proven leases to drill. Would like three partners to complete drilling and producing project for 1961. Ready to drill another well now. S & M Drilling & Production Co., Box 59, Cherryvale, Kansas.

REAL ESTATE

REDUCING YOUR OVERHEAD?
Here's Your Chance!

First Class Office Space . . .
- In heart of Oklahoma City—adjacent to financial district.
- Will remodel to suit tenant.
- Plenty of parking—easily accessible—away from congested traffic.
- Ground floor space and other large areas available—ideal for oil and gas offices.
- Beautiful, modern, air-conditioned building.
- Cafeteria in building serving excellent food—available to all.

Brochure on request—inquiries confidential. Write to J. J. Krisch, Building Manager.

THE HOME STATE LIFE BUILDING
621 N. Robinson, Oklahoma City
Phone CE 2-1161

Classified Advertising in **OIL AND GAS INTERNATIONAL**

. . . is your most effective way to reach 6,000 important petroleum-industry men in Europe, Africa, and the Middle and Far East every month.

If you sell or want used equipment, are looking for or have a job to offer, have or need investment capital, deal in leases or royalties, or provide a service available in the Eastern Hemisphere, you'll want to use this low-cost method of advertising.

FOR RATES

Address Classified Advertising Dept.: Oil and Gas International P. O. Box 1260, Tulsa 1, Okla.

OIL AND GAS JOURNAL
Box 1260
TULSA, OKLAHOMA

Please check one so we can be of more help to you.

- ☐ We sell equipment.
- ☐ We want equipment.
- ☐ Need personnel.
- ☐ Want new job.
- ☐ Buy, sell leases or royalties.
- Other ☐ _____

Classified Advertising may help me. Will you send me complete information, including rates.

NAME _____ TITLE _____
COMPANY _____
ADDRESS _____
CITY _____ ZONE ___ STATE _____

ADVERTISERS

. . . in this issue

Ajax Iron Works 107
Amercoat Corporation 106
Aquaness Department, Atlas Powder Company 26
Autocar, Division of the White Motor Company 30

BJ Service, Inc., A Borg-Warner Subsidiary 52, 53
Baker Oil Tools, Inc. 36
Baroid Division, National Lead Co. 34
Black, Sivalls & Bryson, Inc. 33
Bovaird Supply Co., The 1
BrakeSol, Inc. 32
British Petroleum Company Limited, The 65, 136, 137
Brown Oil Tools, Inc. 56
Bryon Jackson Tools, Inc., A Subsidiary of Borg-Warner Corporation 119
Business Reports, Inc. 131

Cabot Corporation, Machinery Division ..... 4, Inside Back Cover
Caterpillar Tractor Co. 99
Cathodic Protection Service 100
Chrysler Corporation—Dodge Division 132, 133
Classified Advertising 146, 147, 148
Columbus Hotel, The 107
Continental-Emsco Company, a Division of the Youngstown Sheet and Tube Company 7
Cook Company, C. Lee 18
Corrosion Services Incorporated 125

Darling Valve and Mfg. Co. 101
Dayco Corporation—Dayton Industrial Products Co. Div. 113
DeZurik Corporation 104
Dover Corporation—W. C. Norris Division 107, 126
Dow Corning Corporation 13
Dowell 28, 111
Drilling Equipment Manufacturing Co. 2
Du Pont 11

Edward Valves, Inc. 17
Enardo Manufacturing Company 31
Evinrude Motors Division of Outboard, Marine & Mfg. Co. 128

Falk Corporation, The 20

Gates Rubber Co., The 12
General Mills—Chemical Division 23
Goodrich Chemical Company, B. F. (Hycar) 5
Grove Valve and Regulator Company 22
Gulf States Tube Corporation 8, 9

Halliburton Company ..... Inside Front Cover, 3, 114
Hartzell Propeller Fan Co., Division of Castle Hills Corp. 29
Hercules Tool Company 32
Hoke, Incorporated 21
Huey & Co., S. E. 102
Hughes Tool Co. ..... Back Cover
Humble Oil & Refining Co. 16

Macco Oil Tool Co. 102
Maloney-Crawford 120
Martin-Decker Corp. 107
Marwais Manufacturing Division, A Division of Marwais Steel Co. 38
McKissick Products Corporation 127
Mercantile National Bank at Dallas .. 128
Milwhite Mud Sales Company 19
Mission Mfg. Company 123

National Tank Company 150
Nelson Electric Mfg. Co. 108
Norris, W. C., Division of Dover Corporation 107, 126

Oil States Rubber Company 128
Olin Mathieson Chemical Corporation, Chemicals Division 109
Orbit Valve Company 96
Otis Engineering Corporation 14

Rector Well Equipment Co., Inc. 6
Reda Pump Company 112
Reed Roller Bit Company 129
Rockwell Manufacturing Company ... 134
Roper Hydraulics, Inc. 124

Salt Water Control, Inc. 130
Smith Corporation, A. O.—Smith-Erie Division 15
Smith Tool Co., A Division of Smith Industries International, Inc. 110
Southern Natural Gas Company 98
Southwest Equipment Co. 102
Southwestern Graphite Co. 120
Stearns-Roger Mfg. Co., The 51
Stone & Webster Securities Corporation 149

Texaco Inc. 10
Texas Instruments Incorporated 90

Valley Electric Corp. 95

Wall Colmonoy Corporation 104
Well Equipment Mfg. Corp. 103
Worthington Corporation 24, 25

IF you change your address

please be sure to let us know promptly. It takes time to correct the stencil addressing plate. And we don't want you to miss copies of THE JOURNAL.

Also . . . . . .

be sure to give us both

(1) your OLD address

(including company) and

(2) your NEW address

We need them both to make the change. Also confirmation of your company connection and position.

The Oil and Gas Journal

Box 1260 Tulsa, Okla.

This advertisement is neither an offer to sell nor a solicitation of an offer to buy any of these securities. The offering is made only by the Prospectus. This is published on behalf of only such of the undersigned as are qualified to act as dealers in securities in the respective States.

New Issue *May 16, 1961*

$75,000,000

Tennessee Gas Transmission Company

5⅛% Debentures due May 1, 1981

Dated May 1, 1961

Price 100%

and interest accrued from May 1, 1961, to date of delivery

Copies of the Prospectus are obtainable from only such of the undersigned as are qualified to act as dealers in securities in the respective States.

Stone & Webster Securities Corporation — White, Weld & Co. — Halsey, Stuart & Co. Inc.

Blyth & Co., Inc. — Eastman Dillon, Union Securities & Co. — The First Boston Corporation

Glore, Forgan & Co. — Goldman, Sachs & Co. — Harriman Ripley & Co. Incorporated

Kidder, Peabody & Co. — Lazard Frères & Co. — Lehman Brothers

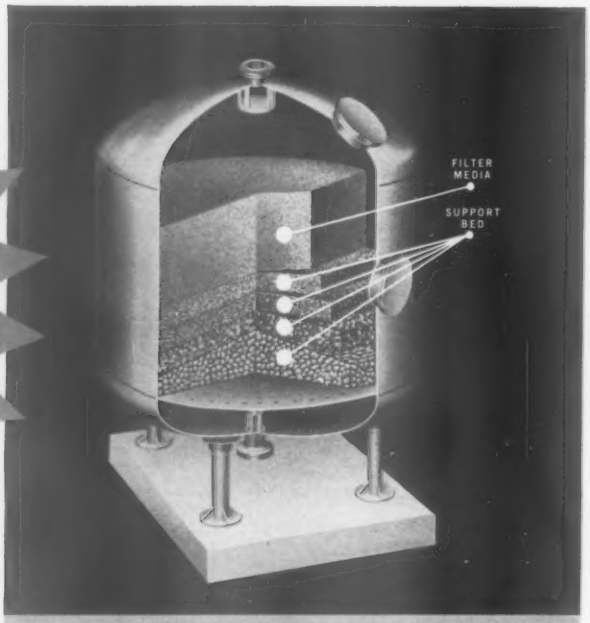
Merrill Lynch, Pierce, Fenner & Smith Incorporated — Paine, Webber, Jackson & Curtis

Salomon Brothers & Hutzler — Smith, Barney & Co. Incorporated — Dean Witter & Co.

NATIONAL®

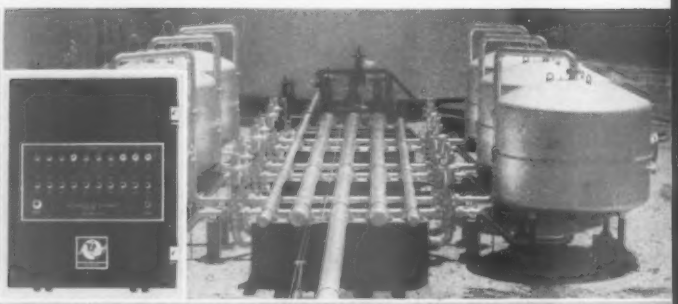
RAPID MECHANICAL WATER FILTERS

FOR WATER DISPOSAL AND WATER FLOOD



National's Multiple Orifice Bed Plate Design with Multiple Graded Bed

Filter manifolds, fabricated from National grooved couplings and fittings and valves, are rigid, leak-proof and afford a great degree of flexibility in assembly. Furnished with manually or automatically operated valves.



National s Automatic Backwash Filter Programmer is a rugged industrial-type electrical control system. Length of backwash may be changed and can be operated manually. Individual filters can be by-passed.

The quality of water can determine the success or failure of a water flood project. Your company has liability insurance to protect against hazards. Why not extend your coverage by buying insurance that your formation will not plug due to suspended solids. When you buy, buy the best — buy NATIONAL!

NATIONAL FILTERS ARE AVAILABLE:

. . . in a variety of sizes and working pressures to suit different capacities.

. . . in horizontal, vertical, pressure and gravity types.

. . . with complete prefabricated and packaged valve manifolds, including all controls for automatic operation.

. . . ready for use after a bare minimum of installation costs.

NATIONAL RAPID MECHANICAL FILTERS can serve you well. They are designed with all the factors in mind that command good filter performance.

It's a National®

NATIONAL TANK COMPANY

DRAWER 1710

TULSA, OKLAHOMA

SERVICE

'ROUND-THE-CLOCK

Pumping unit value is only as good as the service that stands behind it. This is why Cabot maintains convenient 'Round the Clock service centers throughout the oil industry . . . service centers with complete stocks of Cabot parts and manned by factory trained personnel. This is your 24-hour-a-day guarantee that Cabot will deliver dependable pumping. CALL YOUR J&L MAN...

OIL FIELD PUMPING EQUIPMENT
CABOT
PAMPA, TEXAS
FRANKS

CABOT CORPORATION
MACHINERY DIVISION

go all the way with Hughes

For every formation, Hughes has the bit specifically designed to drill it . . . at a saving to you. So why take chances? There are enough risks in drilling as it is.

Go with the bits that are backed by the most extensive research and greatest engineering experience. Go with the bits manufactured under the most exacting quality controls.

Go with the men who can give you the most accurate information on types of bits, drilling weights, rotary speeds and hydraulics to be used in each drilling area. Go all the way with HUGHES. Bit performance records prove that you'll get there quicker . . . and at lower cost!

HUGHES